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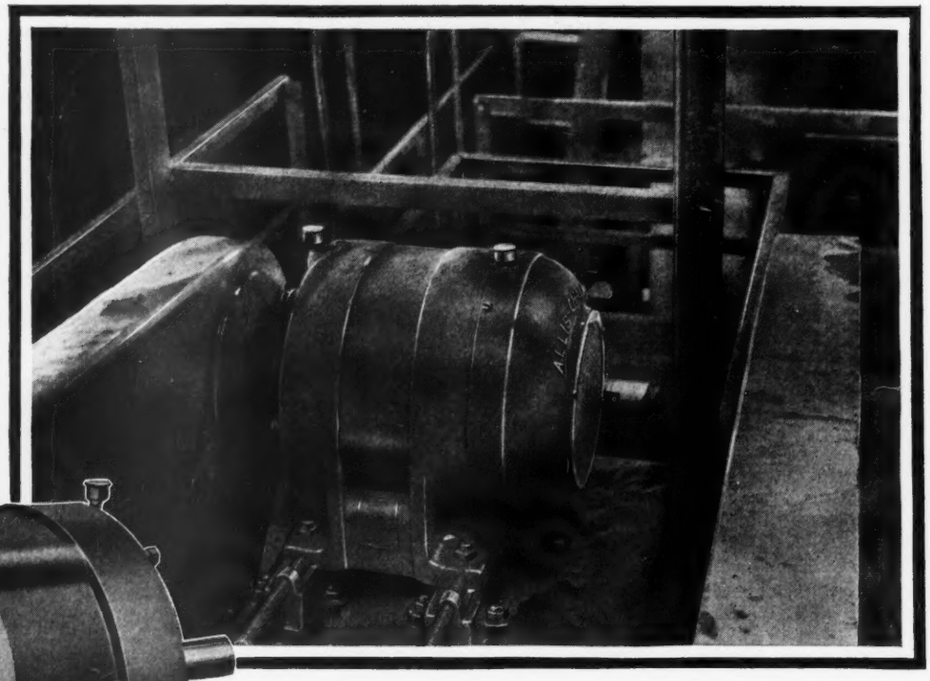

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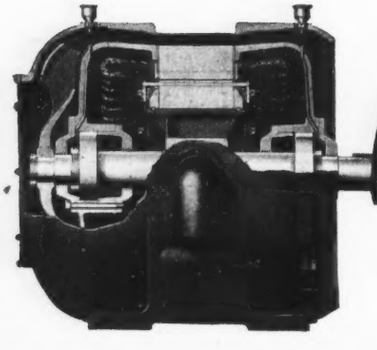

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Editor

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Eight Years of Effort Beginning to Bear Fruit

IN 1921, when the copper industry was virtually at a standstill, as a result of the post-war depression, the Copper and Brass Research Association was formed by a group of American copper mining and manufacturing companies. Since then the organization has made notable progress under the direction of its president, Mr. R. L. Agassiz, chairman of Calumet & Hecla, and its manager, Mr. William A. Willis. Today it includes most if not all of the important American-controlled copper producing and manufacturing companies. By an extensive and far-flung advertising campaign it has dinned into the public ear, with conspicuous success, the advantages of copper as a durable and non-corrosive metal.

Copper, with a thousand and one uses, is more in demand than ever before. Prices have risen in response to this demand, and the producers are now in a position gradually to expand operations to capacity. The industry is in a sound condition. But this condition, one must remember, is not a happy accident. It is the result of foresight and one of the notable instances of that foresight was the formation of the Association.

Progress sometimes involves the sacrifice of immediate good for ultimate gain. American copper producers have recognized the truth of that principle and are now beginning to reap the benefit from its observance. Membership in the Association is comparatively expensive, and copper producers are no more philanthropically inclined in matters of business than are other business men. During the last eight years, marked by price fluctuations and generally unsettled conditions, however, they have continued to give their support to the Association.

The Association is not the only organization of its kind. In England, France and Belgium, Germany, and Japan similar bodies have been formed for the purpose of promoting the use of copper, but the American organization is the most important by virtue of the fact that its members produce about 80 per cent of the world total and that more than half the total consumption is effected within its field. This condition will not be a permanent one. Production from South Central Africa, it is said, will be an important factor in the world market in 1935. By that time, also, Noranda, Flin Flon, Sherritt-Gordon, and the Frood mines will probably be operating at full capacity, and, together with Howe Sound and Granby, will put Canada well up among the leading copper-producing countries of the world. These new interests should recognize the value of copper and brass associations and should take part in their activities. The work that such organizations have done and are doing is not of the static variety. Its effectiveness depends on the acumen and foresight with which it is carried on. The public, as has often been remarked, is prone to forget easily, and any relaxation in the efforts to promote the use of copper may be reflected in a corresponding slackening of demand.

The Rôle of the Metals as Constituents of Foodstuffs

MAN is merely a unit in the great program of organic life, drawing sustenance from the animal and vegetable kingdoms. Until comparatively recent times our appreciation of the need for an adequately balanced diet was borne home to us by the realization that a deprivation of certain constituents of certain foods resulted in a lack of balance, leading to disease and death. Beri-beri was caused, it was determined, by polishing the grain in the food of rice-eating peoples; and since that discovery a gradual accumulation of knowledge has been effected in regard to the properties, affects, and classification of what are known as vitamins. This research was in line with a tendency that has been brought to the fore in recent years—to analyze more thoroughly the factors of influence that lead to the obvious necessity for variety in diet—to determine what are the precise reasons for inhibited or stunted growth, or disease, on the one hand, and vigorous health and prolific reproduction, on the other. The result has been to disclose the interesting fact that the research, to be logical, demands a complete study of organic existence —of the life history of vegetables and animals, as well as the life history and physiological reactions of the members of the human family who consume them as food. The whole study is broadening at an amazing rate, providing data of fascinating appeal.

The mining industry should be interested in these discoveries. In the question of the availability of an essential element such as iodine, for example—a by-product of a mining industry—the investigation goes back further than the determination of the iodine content of the thyroid gland of a person suffering from goiter: one may now inquire as to the iodine content of the food provided for the cow whose milk supplied, in part at least, the ration for the subject under examination. Similarly, minute amounts of copper have been proved to be a potent factor in the establishment of a proper condition of human health, particularly in the treatment of anemia; but research is being carried back beyond the question of the copper content of the foodstuff eaten —back to the scope that may exist for the addition of copper, in the form of a soluble salt, as an essential or a

corrective in the diet of the plant itself; and the important discovery has been substantiated that minute quantities of such an element—and, probably, of many other elements as well—are as essential to vigorous plant life as they are to vigorous animal life, which may be taken to include the human cycle.

This new conception of the rôle of minute amounts of the metals and of definite chemical compounds in the proper functioning of organic life was treated at length in a scholarly presidential address delivered by Dr. Oswald Schreiner, Chief of the Division of Soil Fertility, U. S. Bureau of Chemistry and Soils, before the Association of Agricultural Chemists assembled at Washington recently. "It is to be expected," says Doctor Schreiner, "that the less-common elements, considered for convenience' sake as non-essential, will be found to be the most important factors in plant and animal nutrition, metabolism and health," reference being made especially to elements such as manganese, copper, boron, iodine, zinc, arsenic, barium, strontium, caesium, titanium, chromium, vanadium, aluminum, silicon. The subject is inspiring in its possibilities of effecting a more scientific control of healthy conditions. It deserves the attention of all who are interested in the minor applications of basic materials in the metallic and non-metallic industries.

A Tailspin in Geology Produces Vertigo

THE two paragraphs given below are part of a report. Their significance is left to the reader to discover. To repeat the context would not help him:

"These granitic hills as they rose carried the overburden of sedimentaries deposited under the ocean over the granitic floor but beneath the granitic crust latent giant forces are ever in the waiting ready to apply these forces with an irresistible pressure forcing the bending of the granitic structure causing a buckling as a sequence generating an intense heat and in turn an incalculable cataclastic condition converting the overhead sedimentaries into the metamorphic family of rocks and in turn bestrewing the new laid BED-PLANE with an indeterminable amount of MARINE MATTER.

"By the chemical action and re-action of sulphur, lime, iron and associate elements, distillation is brought about by the generation of heat, the resultant being the production of sulphuric acid, hence as a sequence the oil and hydro-carbon gas is released from the marine matter, and in turn produces the uplifts or anticlinals the resultant action thru slipping of the structure produce our much dreaded quakes in the SEDIMENTARIES."

The paragraphs are not quoted in a spirit of ridicule, nor are they given to provoke a laugh. They indicate a confusion of ideas in the mind of the author, who no doubt is sincere in his efforts to unravel the processes of Nature; but the statements do not carry conviction, nor could they be expected to enhance the value of the report in the opinion of those to whom it was submitted. If the recipients are competent in geological science, the report may be discredited; if not, the paragraphs are unconvincing because of an effulgence of haphazard ideas.

To the intelligent reader, a mining report will excite interest and inspire confidence in proportion to the degree to which the author is known to be a competent observer and a reliable engineer, or because of the careful presentation of observed facts and the accuracy of deductions, or by reason of the restraint shown in advancing conclusions when the facts upon which they are based are meager.

The genesis of a deposit may be presented if it can be deduced accurately. General geology may add to the value of a report, but it must be understandable. In many instances the genesis of an ore deposit and the general geology of a mineral deposit are subjects of secondary importance. Even though the facts about geological structure may be pertinent to an inquiry, attempts to visualize dramatically the history of events that might have caused such a structure are likely to be unconvincing.

The Arabs Are Responsible

THE quest of the ultimate, the great prime mover, the original cause of things, is hopeless. Not for mankind apparently is it to know. The problem clearly transcends human capabilities. But the mystery of it all spurs the scientific inquirer on, driving him deeper and deeper into the unknown, where he uncovers new truths in passing, but finds the ultimate as baffling as before. Lesser men content themselves with lesser riddles, which they have some chance of solving.

As the editor weighed these ponderous thoughts, the morning mail brought to his desk two volumes, both of them outpourings of some government bureau—statistics, in all some 1,300 pages—an appalling array of columns and tables. Here was a mystery, indeed—one of the lesser sort, but baffling. Who wanted all this, and why? One, apparently, seeking to bolster up an argument; a salesman, perhaps, wishful of hypnotizing a prospect; or a speaker doubtful of his ability to convince his audience and therefore falling back on figures, in line with Senator Sorghum's classic advice. Very few had need of it, if any. Yet what a huge amount of labor was represented. Many clerks had toiled unnumbered hours, and adding machines had clicked unceasingly. Where lay the responsibility? The question was hard to answer, for who can fix responsibility for an act of government? A clew, at last, was afforded by close study of the pages. A certain repetition caught the eye and photographed itself upon the mind, occurring too frequently to be ignored: In all this maze of figures only ten characters were employed! Over and over again, in forever-changing combinations, like the endless rearrangement of the collection of colored glass in the kaleidescope, which is the child's delight and the designer's tool—these ten sufficed to produce the maze of figures. Here was a glimpse of light! The numerals had something to do with it. Without them, statistical abstracts of a nation's business would certainly be shorter. Imagine "Statistics of Income for 1926" in Egyptian hieroglyphics, in cuneiform, or in Chinese ideographs. Clearly, the numerals had made possible these awful compilations. The conclusion was convincing. At last the culprits stood revealed—the inventors of the numerals. The Arabs were responsible.

But what was to be done about it? Elation over the solving of the mystery disappeared before this new and baffling problem. Knowing bureaus and bureaucrats as he did, the editor felt the case was hopeless. Submission to the deluge of figures was the only attitude to adopt. With submission would come forgetfulness; and peace of mind; and, perhaps, new inspiration.

Relative Voting Influence of Agriculture and Mining

WILLIAM M. JARDINE, Secretary of Agriculture, recently advised American farmers to "hold their wheat" to prevent undue price depression and to secure a more favorable return on their product. The value of his advice can be determined only if accepted, and conclusions must await the result of final sales. Secretary Jardine's quasi-official pronouncements are unlikely to meet any serious objections from Mr. Average Citizen, even if a small advance in the price of bread or flour should result. The agricultural industry has done such remarkable work since the war in advertising its so-called depression and lack of prosperity that any action to improve conditions will be welcomed by the general public as commendable.

Sound analysis, however, reveals little to warrant the action of Mr. Jardine, if one forget the sentiment toward "farm relief." He has, in effect, advised an industry, in order to secure an enhanced return for its goods, to bring pressure to bear on the general public by lessening, temporarily, the supply of a basic commodity. It may be recalled that Mr. Jardine's advice was not to curtail a given rate of production, but to create an artificial condition by holding back raw material already produced.

Consider another picture, with the mining industry as the recipient of similar advice. Even the most prosaic of imaginations can foresee the widespread public indignation that would follow the offering of advice, by some responsible officials of the Department of Commerce, to the copper, lead, or zinc producers, to withhold accumulated stocks of metal from shipment to consumers pending an upward price readjustment.

Obviously, agriculture has its privileges, the reason for which is not hard to find. As an industry, it is composed of many small units, each of which must be considered, politically, because of its potential voting power. Mining, on the other hand, is an industry of large units, with the aggregate voting power—or labor—generally resting on the opposite side of any political question from the unit leader, or mine operator. So long as this condition exists, political sentiment will concentrate on agricultural relief.

The solution of the problem requires thought on the part of mine owners and operators. They must expect to face a hostile public opinion in most of the moves they make. Only by educating their employees to the fact that what is good for the mine owner is good for the mine laborer can they ever expect to reach a plane of political consideration comparable to that achieved by agriculture. The action of many of the copper producers in advancing wages as a consequence of increased mine earnings from higher copper prices is an illustration of the right kind of educational work. An even better policy is that of encouraging employee stock ownership.

The Translator and the Field of Geophysics

WITHOUT the services of the translator the science and literature of a people would be imperfectly known to those speaking another tongue. Difference of language would amount to a Chinese wall thrown about a nation, isolating and narrowing it intellectually and in all ways retarding development. The translator breaks down this barrier. He is the interpreter between nations, the liaison officer who effects a better understanding, the engineer who bridges the otherwise impassable gulf between minds. He serves in disseminating information among mankind, stimulating it to new endeavor, even as does the technical press within an industry.

The rôles of both interpreter and engineer are combined when translation of a technical work is undertaken. An example of this, in the limelight at the moment, though of an exceptional sort, is the Hoover English version of Agricola. Many other and modern instances in the field of technical literature might be cited, the most recent being in the domain of geophysics. This is the translation into English of Ambronn's "Metoden der angewandten Geophysik," undertaken for the McGraw-Hill Book Company, which has just appeared. As a comprehensive exposition of the fundamentals of the science, it will serve for the present at least to make up for the lack of textbooks in English on the subject. At the same time it will undoubtedly stimulate the geophysicists in American practice to supplement it with volumes of their own production.

Non-Ferrous Metals Find Increasing Usefulness

TO PARAPHRASE an old saying, in the making of magazines there is no end. Among newcomers, some are futile, if not objectionable; many seem to play no part in that orderly and economic scheme of things that is so underlying a philosophy of American progress; and some are welcome and inspirational. In the last-mentioned class may be mentioned *The Metal Arts,* the first number of which, dated December, 1928, appeared before the middle of November, in anticipation of the calendar—a practice borrowed from the fiction field, conveying no significance of intelligent import.

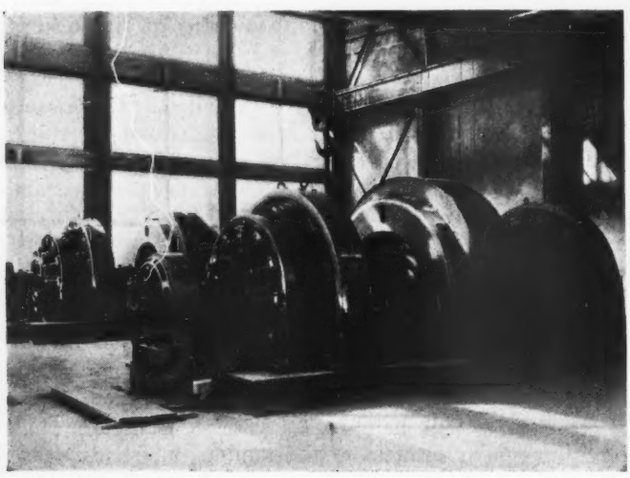
The new magazine, edited by Mr. Eugene Clute, carries the sub-title "A Journal for Architects, Decorators and Craftsmen in Metal." It is addressed to those engaged in the practice of architecture and the application of art to metal working. A glance through its pages reminds one of the generous expansion that has occurred in recent years in the use of brass and bronze in construction work, especially in the modern office building. The reproductions of entrances and doors give an impression of quality and character in design and material, permanence, and beauty of form. *The Metal Arts* will prove useful and instructive. A wider knowledge of the infinite variety of ways in which metals can be used by the craftsman will help to increase consumption and foster a popular interest in the mining industries.

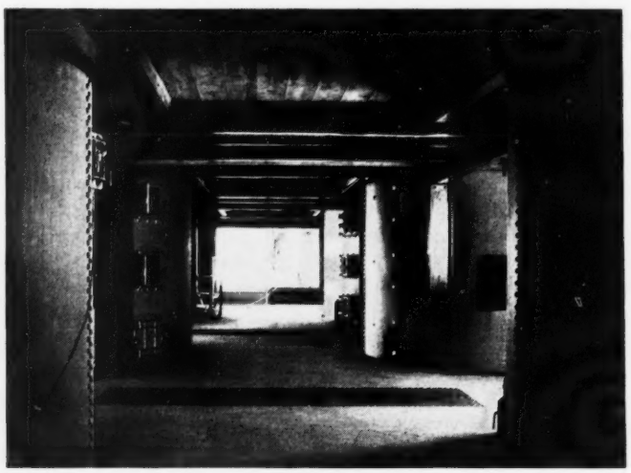
THE Sullivan Electrolytic

By U. C. Tainton

THE electrolytic zinc plant of the Sullivan Mining Company, owned jointly by the Bunker Hill & Sullivan Mining & Concentrating Company and the Hecla Mining Company, was erected to treat the zinc-bearing ores of the Coeur d'Alene district. These ores canot be classed as particularly favorable for electrolytic treatment, inasmuch as they tend to form an unusually large amount of insoluble zinc ferrite in the roast, and they also yield considerable quantities of gelatinous silica in the leaching operation. In addition, they contain relatively large amounts of cobalt, which is one of the most troublesome of impurities from the standpoint of electrolytic zinc treatment. For these reasons the Sullivan plant has been designed to make use of the high-acid process described by me in previous publications. In this process the return electrolyte used for leaching carries 28 to 30 per cent free acid, and the electrolysis is carried out at a current density of 100 amp. per square foot, both of these two amounts being about three times as great as the corresponding figures in ordinary electrolytic zinc practice.

Substation motor-generator sets, each of 4,000 kw. capacity





Roaster floors, showing steel and concrete construction

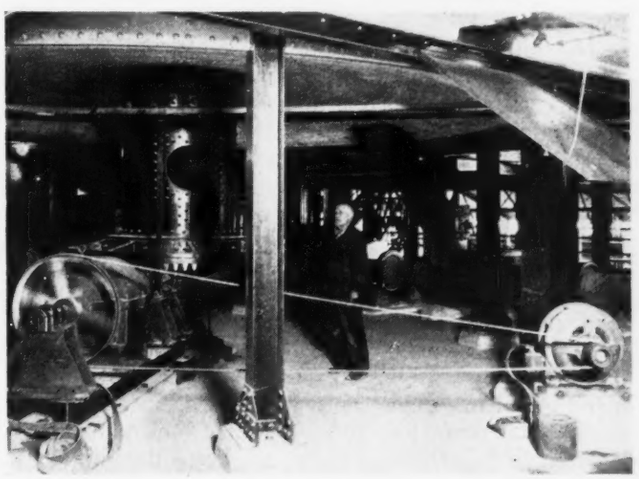
The plant is at the upper end of Government Gulch, at a distance of about two miles southwest of the town of Kellogg and at an elevation of about 400 ft. above the Coeur d'Alene River. This site was chosen because it was already supplied with railroad tracks and afforded a convenient hill immediately behind the plant upon which the stack could be placed. The elevation so secured, together with the 250 ft. height of stack, permits the discharge of roaster gases at a point about 1,000 ft. above

Zinc Plant

the valley bottom, and gives good insurance against smoke damage.

The feed to the plant consists chiefly of concentrates from local mines. Some high-grade ore will probably be treated direct. Those in charge of operations anticipate that the average grade of plant feed will be not less than 40 per cent zinc; the plant was designed on this basis.

Concentrate comes into the plant on the upper track and is discharged directly into the ore bins below, which are of reinforced concrete and of a capacity of 1,200 tons. From these it is delivered by apron feeders to a conveyor belt, which passes along the front of the bins. It then goes over a weightometer, through a set of disintegrating rolls, and up an elevator to the feed bins of the roasters. The five roasters are of standard Wedge construction, 25 ft. outside diameter and provided with seven roasting hearths and one drying hearth. To secure increased capacity and better roasting, special attention has been paid to the circulation of the gases in the furnace. The drop-hole area has been greatly enlarged. Hot-air arms are provided on the lower hearths, having holes drilled along the length so as to produce a circular motion of the gases on the hearth. The air for these



Roaster drive, with Jacoby conveyor in background

arms is provided by the cooling air from the rabble arms on the upper hearths. All rabble arms are air cooled; and on the hot hearths the arms and rabbles are made of high-temperature resisting alloy. Firing of the furnaces is done by means of Mahr oil burners, and temperatures are taken on each hearth by recording pyrometers.

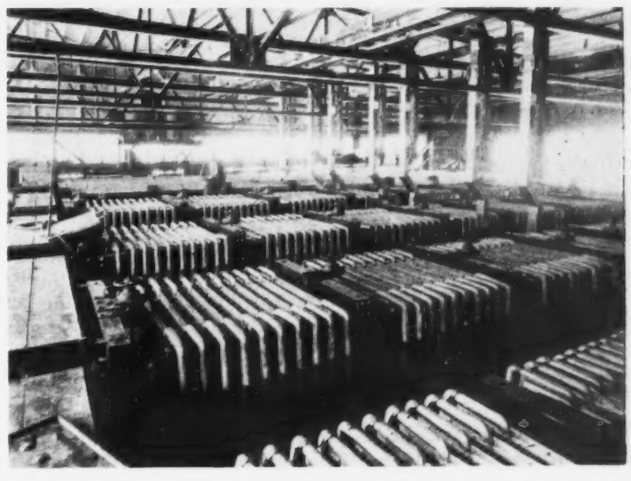
Roaster gases travel through a steel flue of standard balloon type, 10 ft. wide and about 1,000 ft. long. The Cottrell treater, of the plate-and-wire type, is at the upper end of the flue at the base of the stack. The stack and flue system has been designed so that no extension will be required when the plant capacity is increased to 150 tons of zinc per day.

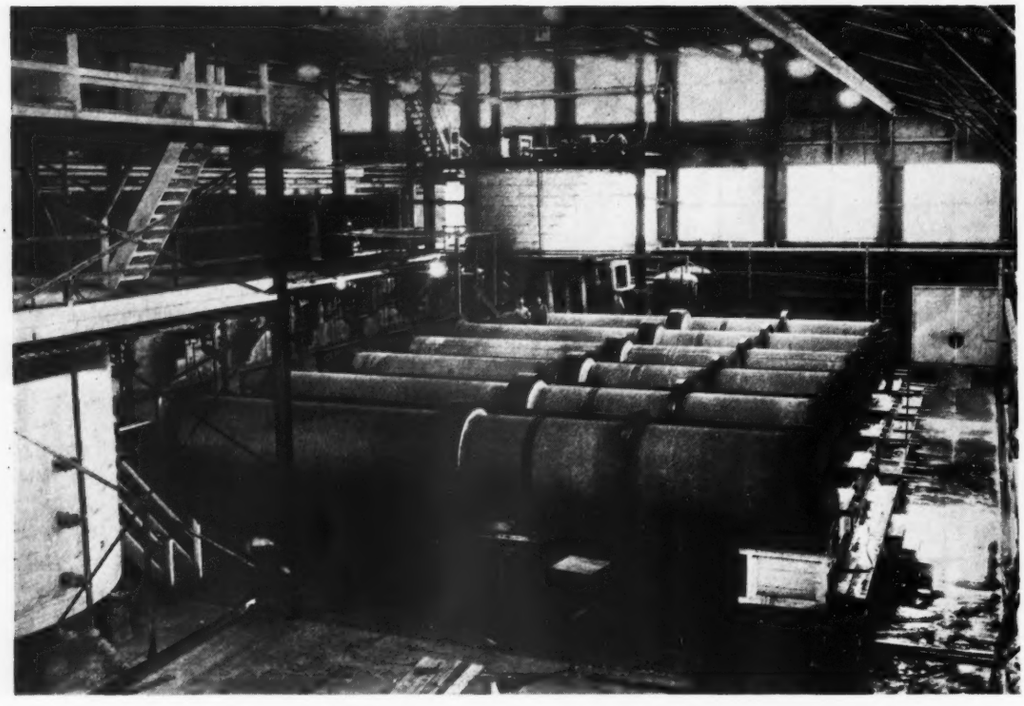
Calcine from the roasters is discharged to a Jacoby conveyor and thence to an elevator, which delivers it to a Leahy screen equipped with 20-mesh wire cloth. Oversize from this goes through a set of rolls and is returned to the roaster feed. Calcine passing through the screen goes directly to two magnetic separators, of the Weatherill cross-belt type, built by the Dings Manufacturing Company. The main belt of each conveyor is 24 in. wide and has a rated capacity of 75 tons of calcine per day. The separators take out from 30 to 50 per cent of magnetic material, and this drops directly to the "Ferrite" bins below. That portion which is nonmagnetic drops over the end of the belt and goes to the "Oxide" bins. From these bins the calcine is taken by a system of screw conveyors and elevators to the weighing bins above the primary agitators. There are three bins above each agitator—one ferrite, one oxide, and one for manganese ore. These bins are of 10-ton capacity and are equipped with individual feed, the entire unit being carried on Fairbanks dial scales so that the weights fed into the agitators can be read directly by the operator.

The primary agitators, three in number, are 20 ft. in diameter and 14 ft. 6 in. deep. When filled to a depth of 9 ft., they contain enough pulp at each charge to produce 15 tons of zinc metal in the cell room.

In starting a charge, return electrolyte, previously heated to 60 deg. C., is pumped into the agitator tank. A charge of ferrite is then run in, a quantity of manganese added to oxidize the iron, and the tank allowed to agitate for one hour to permit decomposition of the zinc ferrite. The feeder of the oxide bin is then started and addition continued until all of the iron is precipitated, as shown by a test with thiocyanate spot paper. Before the end of the reaction the pulp comes up to boiling temperature and a considerable quantity of water is evaporated, stacks being provided to take care of the steam evolved. After the charge is neutralized, the

Cooling system, showing busbars and connecting coils to electrolytic circuit for cleaning





Burt filters, intermediate storage tank and primary agitators (above)

pulp is dropped into a storage tank of the same size as the agitators, and thence it feeds to the Burt filters. There are six of these, each 5 ft. in diameter by 40 ft. long, driven by a variable-speed motor, which allows a rotational speed of from two to eight revolutions per minute. A charge of pulp is dropped into a filter, the solution separated and the cake washed with water, after which the residue is repulped in the filter and sent to a Dorr thickener. From this thickener the residue feeds to an Oliver filter and thence to a Ruggles-Coles drier, which reduces the moisture to a point that makes it easy to handle the residue for shipment. Overflow from the Dorr thickener is not used as wash water, but is returned for repulping a fresh charge. The washing in a Burt filter is so complete that the amount of soluble zinc in the repulping water is unimportant.

Solution from the Burt filters goes into the purification system, where copper, cadmium, and cobalt are eliminated. This is done in mechanical agitator tanks, 22 ft. in diameter and 12 ft. deep, holding solution sufficient for the production of 28 tons of zinc at a single charge. Here the solution is agitated with zinc dust which, at a temperature of 80 deg. C., precipitates these metals completely. The purified solution ordinarily contains less than 5 mg. per liter of cadmium and copper and less than 2 mg. of cobalt. After the metals are precipitated, the residue is pumped by means of centrifugal pumps through Shriver filter presses having 35 frames, each 36 in. square. After filtration, the solution drops to two storage tanks known as check tanks, each holding 250 tons of solution. Each lot of solution is checked by the laboratory before being pumped over to the neutral storage tanks, whence it feeds to the cell circuit. This system minimizes the danger of getting impure solution into the electrolytic circuit where it would lower the grade of the zinc produced and possibly give trouble in electrolysis.

The electrolytic division contains two circuits, each of 4,000 kw. capacity. Each circuit is supplied by a motor-generator set giving 8,000 amp. at 500 volts on the direct-current side. There are 150 cells in a circuit, each taking 8,000 amp. The synchronous motor operates at 2,300 volts and is rated at 4,400 kva. Each cell contains 10 cathodes having a submerged area of 4 sq.ft. on each side and taking 800 amp. in normal operation. The cathodes are of ordinary commercial aluminum sheet, having an aluminum conductor bar welded at the upper end. Current is led into the conductor bar through a spring clip at the side of the cell, and the end of the bar is copper plated, to provide a good contact. This construction has proved greatly superior to the type previously used with copper bar riveted to the aluminum plate.

The cathodes slide in grooved wooden guides, which are fixed in the cell with a wooden framework. This framework also holds the anodes in fixed position and at a definite spacing from the cathode face. Two anodes are between each cathode, so that the electrode spacing may be readily varied. The anodes are perforated to permit free circulation of the electrolyte and decrease the terminal voltage. During operation, solution is circulated to all cells in parallel from a feed launder directly over the center of each cell. The solution drops through a hard-rubber pipe to the center of the cell and overflows at each end, also through hard-rubber pipe, down to a sump below. From this sump it flows through a thickener, where manganese dioxide is recovered, and the overflow then passes to a storage tank known as a balance tank, which is used to keep the circuit in balance when adding and withdrawing solution. From this tank the solution is pumped by means of Antisell-type hard-lead pumps through a system of cooling coils and back to the electrolytic cells. The solution circulates at a rate such that the entire volume passes around the circuit once every 1½ hr. This has the result of keeping the composition of the solution in all cells practically the same and produces uniform conditions for electrolysis.

Solution is admitted to the cell circuit in batches about once every 24 hr. This reduces the acid strength in the circuit down from about 28 to 22 per cent, which is the normal range of electrolysis. When the acid has risen

to the proper point, a batch is withdrawn from the circuit and pumped up to the acid-storage tanks. A corresponding quantity of neutral solution is then dropped in order to bring the volume of the circuit back to normal.

Manganese dioxide precipitated during electrolysis is pumped as a sludge from the manganese thickener, filtered, washed, and prepared for market. Ordinarily the manganese dioxide as produced at other plants carries so much lead as to be without commercial value, and it is therefore returned to the circuit. In our case, the manganese dioxide is practically free from lead and in excellent condition, for instance, for use as an oxidizer in batteries.

Many interesting design problems were encountered in connection with the special features of this plant. One of these related to the choice of the proper type of electrical equipment. The general consensus of opinion among the electrical engineers favored the installation of rotary converters on account of their higher conversion efficiency. The metallurgists, on the other hand, expressed a preference for motor-generator sets because of their greater flexibility and freedom from interruption caused by line disturbances.

Power for the zinc plant is delivered from the lines of the Washington Water Power Company, and the generating stations are distant 100 miles or more from the point where the power is used. A careful survey of the whole situation was made.

Investigation disclosed the fact that a motor-generator set having the required characteristics would approach within 2 per cent or less of the efficiency of the rotary converter. The motor-generator was practically immune from damage from flashovers arising from surges on the line. These, it appeared, were likely to be rather serious in a long line having a number of heavy loads at the far end of it. Moreover, according to the best information that we were able to obtain, the time required for inspection, cleaning, and general maintenance of the rotary converter would normally amount to not less than 72 hr. per year, whereas the motor-generator set required only about one-third of that time. Inasmuch as the plant was designed without spare generating equipment, any involuntary shutdown not dictated by the exigencies of the metallurgical operation represented a loss of about $200 per hour. The difference in this respect between the two types of equipment was alone sufficient to offset the greater difference in efficiency of the rotary converter, and led eventually to a unanimous choice in favor of the motor-generator set.

In the roasting and leaching division, the plant design followed closely the lines determined upon at the pilot plant previously described. The most important change was that in the design of the Burt filters, whereby they might be used for repulping the cake and discharging the repulped product. This permitted the substitution of a simple type of hand-operated discharge door instead of the heavy, hydraulically operated door previously employed.

In the electrolytic division an interesting problem arose in connection with the choice of the best type of cooling system. Deposits tended to form on any cold surface that might be employed for cooling, and in previous work these deposits had been cleaned off mechanically at intervals. In the present plant the cooling system consists of several long boxes about 4 ft. square, down which the solution flows. Placed transversely across these boxes are flat lead coils through which cooling water is circulated counter-current to the solution flow. To prevent the formation of deposits on these coils, lead grids are placed between the coils and provision is made for connecting the whole system in series with the cell circuit so that 8,000 amperes can be passed through the solution from the grids to the coils, the coils, of course, being the cathodes. This operation is done at short intervals and results in plating a thin film of zinc on the coils. This, as it goes back into solution, evolves hydrogen and breaks off any adhering crust or scale, so keeping the coils at their maximum heat-conducting efficiency.

A considerable amount of study was given to the question of the best method of raising the cathodes from the cells when collecting the zinc. Finally, at the suggestion of Mr. Dan Bosqui, it was decided to perform this work

Slab zinc, 99.99 per cent, ready for shipment. Left to right C. M. Palmer, Daniel Bosqui, U. C. Tainton and E. R. Crutcher.

by means of an overhead platform placed above the cells and about 9 ft. from the floor. This platform also serves as a gangway for attendance to the feed launders. When pulling cathodes, the operator goes down the line of cells and from the platform above he raises one cathode from each cell by means of a wooden rod worked through a slot in the floor. The hook on the rod engages in a hole in the top of the cathode and the cathode is raised vertically until its lower edge is just clear of the solution. At this point it is suspended by means of a stop on the rod and allowed to drain for a few minutes. The operator on the cell floor below follows a few minutes behind the first man and takes the cathodes from the hook for stripping. Working in this way the electrolytic current is kept uniform at all times, with a resultant high load factor. Also, the corrosion of equipment caused by dripping of acid from the ends of the cathodes is avoided. The labor requirement is surprisingly light: one man can raise the cathodes from 150 cells in a few minutes. It is believed that this is the first instance of building a cell room in three decks: the lowest one for the collection of solution from the cells, the middle one the cell floor proper, and the upper one for manipulating and raising cathodes.

The Story of 99.99 per Cent Zinc

One of the most important of the recent developments in the process has been the production of very high-grade zinc. This arose in the following way:

A research was instituted at the laboratory of the Bunker Hill company to determine whether it might be possible to lower the discharge potential of oxygen at a lead peroxide surface by the addition to the anode of some other element. That improvement might be possible in regard to preventing disintegration of the plain lead anode, and so obtaining a zinc deposit and a manganese dioxide lower in lead than had been obtained in the ordinary way, was also known to be a fact. The research has covered many elements—in fact, all that we were able to alloy with lead metal. Although this work is not yet complete, we have been able, by employing an alloy of which lead represents almost 99 per cent, to lower the terminal voltage by 5 per cent and also to obviate almost entirely the disintegration of the lead surface. As a result, the lead in the deposit of zinc has dropped to about one-tenth of what had been present previously, and at the same time the lead content of the manganese dioxide is only about 5 per cent of its former amount.

After it became possible to produce practically lead-free zinc, more attention was given to the elimination of other impurities. Fortunately the conditions of the process, on account of the hot solutions, lend themselves to purification of the solutions to a high degree. The result has been the production of zinc of so high a grade that it required the development of special methods of analysis to detect any impurities at all. The average grade of the metal so far produced has been consistently above 99.99 per cent.

Control of Acid Spray

An interesting minor development has been the discovery of a method of preventing the acid spray from the cells. During electrolysis the gas evolved at the electrodes rises to the surface in the form of small bubbles, and when these burst they throw minute droplets of acid solution into the air. At the other plants this acid mist constitutes a serious nuisance and hazard to health. Here again an extensive research was carried out to discover a protective layer for the surface of the electrolyte that would confine the spray. Oils and oleaginous substances generally, were found to be valueless for this purpose, because sooner or later the oil inevitably spread down on to the zinc and caused a spongy deposit. The problem was, therefore, attacked from the standpoint of finding some reagent that would produce a more or less permanent froth on the surface of the solution. Eventually, a combination of reagents was found which performs this function very satisfactorily. It is not necessary for the workmen to wear respirators, and, in fact, the acid spray in the cell room is normally not perceptible, even to visitors. This means a good deal in regard to the efficiency of the operators and also in the maintenance of contacts and cell-room equipment generally.

We were singularly fortunate in that the starting up of the plant did not develop nearly so many difficulties as one would normally expect. The first month's operation of the cell room showed an electrolytic load factor exceeding 97 per cent. Such minor troubles as have arisen came chiefly from lack of experience of the operating force—very naturally, inasmuch as we were dealing not only with a new plant but with a new process as well. For our relative freedom from starting troubles we are indebted to the advice and criticism of a large number of friends, but chiefly to the liberal policy of the parent companies—that the best that could be obtained was none too good for the structure that they had set out to build.

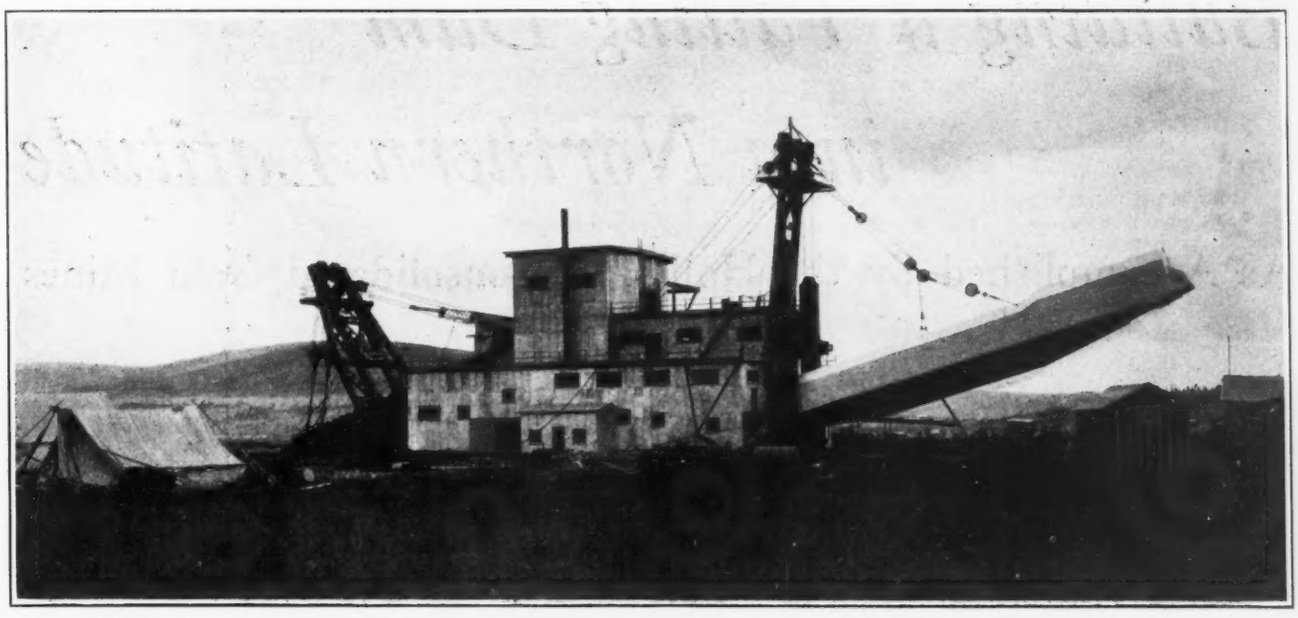
Feldspar—a Mineral of Widely Diversified Uses

THE average person has little knowledge of feldspar, points out the U. S. Bureau of Mines. And yet, the plate from which one eats his meal is glazed with feldspar and our enamel cooking ware and enamel sinks and bathroom furniture are practically all glazed with a composition containing feldspar. In fact, the uses of feldspar are manifold. Its principal use is as a flux in the pottery, glass, and enameling industries, including tiles, porcelains, and so-called marbles that find their industrial application in hotels, restaurants, drug stores, and other places where a vitrified surface is desired for sanitary reasons. It is also used as an abrasive in scouring soap, as a binder in the manufacture of abrasive wheels, as poultry grit, as a constituent of roofing material, and in stucco or pebble dash. Small quantities of the purest grades of potash feldspar are used in the manufacture of artificial teeth. Efforts to use feldspar as a source of supply of potash on a commercial scale continue, but claims of success remain for the present unestablished.

Probably all the feldspar consumed industrially, except that used for facing cement work, for covering prepared roofing, for "chicken grits," and like purposes, is prepared by fine grinding. Even for such uses the spar is at least crushed to small sizes and more or less graded by screening.

Information in regard to the feldspar industry of the United States is contained in the Bureau of Mines publication, "Feldspar in 1927," by Jefferson Middleton, which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 5c.

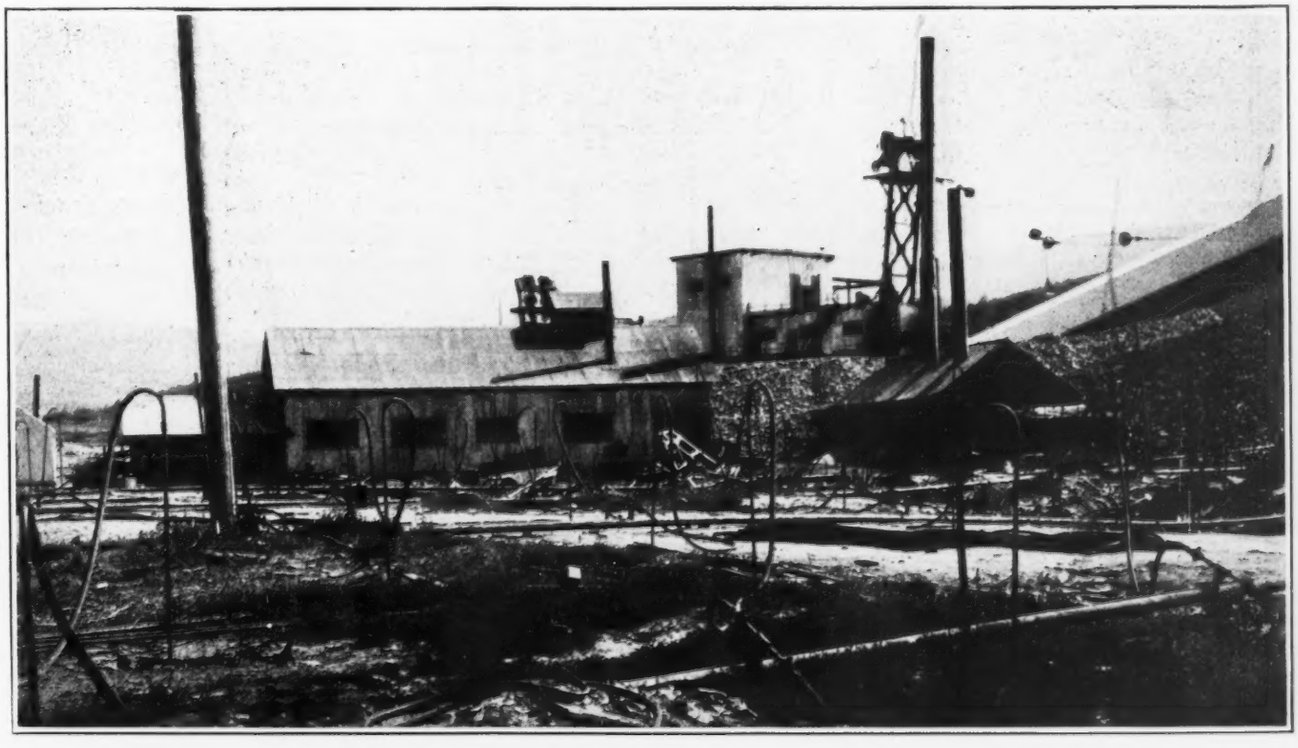
Large-Scale Dredging in Alaska



ABOVE is shown the new dredge of Fairbanks Exploration, a U. S. Smelting Refining & Mining subsidiary, at Goldstream, near Fairbanks, Alaska. This is one of three dredges which the company placed in operation this year. They have handled about 25,000 cu.yd. of gravel daily. A fourth dredge is expected to be ready early next spring.

COLD-WATER operations of the company on Cleary Creek, near Chatinika, are shown below. Holes are drilled into the ground at regularly spaced intervals, pipes introduced into them, and water is pumped through at a slight pressure. Cold water has been found more effective than warm water or steam for this purpose. A 72-mile ditch was constructed to provide the water for this purpose and for stripping off the bed of muck which covers the stream gravels. In the background may be seen the new Chatinika dredge.

THE third dredge is in operation on Gilmore Creek. This ambitious enterprise is said to have cost $10,000,000 before production started. The town of Fairbanks has been going through a second "boom period" as a result of these activities.



Building a Tailing Dam in a Northern Latitude

As Accomplished by the Hollinger Consolidated Gold Mines

By A. H. HUBBELL
Associate Editor

THE necessity of disposing of several thousand tons of tailing each day from milling operations will present difficulties to any mining company unless it is favored with exceptional conditions as to topography, legal restrictions, and ownership of surrounding land. If to these difficulties be added others resulting from a vigorous climate, such as that of the Porcupine district, in northern Ontario, the resulting problem will resemble that which confronted the Hollinger Consolidated Gold Mines in the aforesaid district, a few years ago, and which since then has been solved to its satisfaction.

A quick means of getting rid of tailing is seemingly afforded by the numerous lakes of the region. Hollinger, at the outset, ran its tonnage into a small pond near the mill. When this filled up, as it quickly did, the flow was diverted to another lake (Gillies) also used by the McIntyre Porcupine Mines. However, the lakes of the vicinity are small and shallow and the fact quickly became apparent that such measures would not suffice for Hollinger's large and steadily increasing requirements.

Another method that suggests itself is stacking. But this is impracticable in the Porcupine district, on account of the severe winter climate. Without excessive heating provision ice would quickly shut down the conveyors required for the purpose or would make it difficult to shift them, as must be done from time to time. In view of the distance that the tailing-disposal site must be from the mill and the low temperatures prevailing through so many months of the year, pumping through pipe lines is not only the most practical but the least expensive method of transportation, both as to capital expenditure and cost of operation.

Impounding, then, is the only practical means that will serve the operator for any length of time. To do this at a reasonable cost it is necessary to find a tract of land close to the mill and sufficiently big to take care of the tonnage over a period of several years.

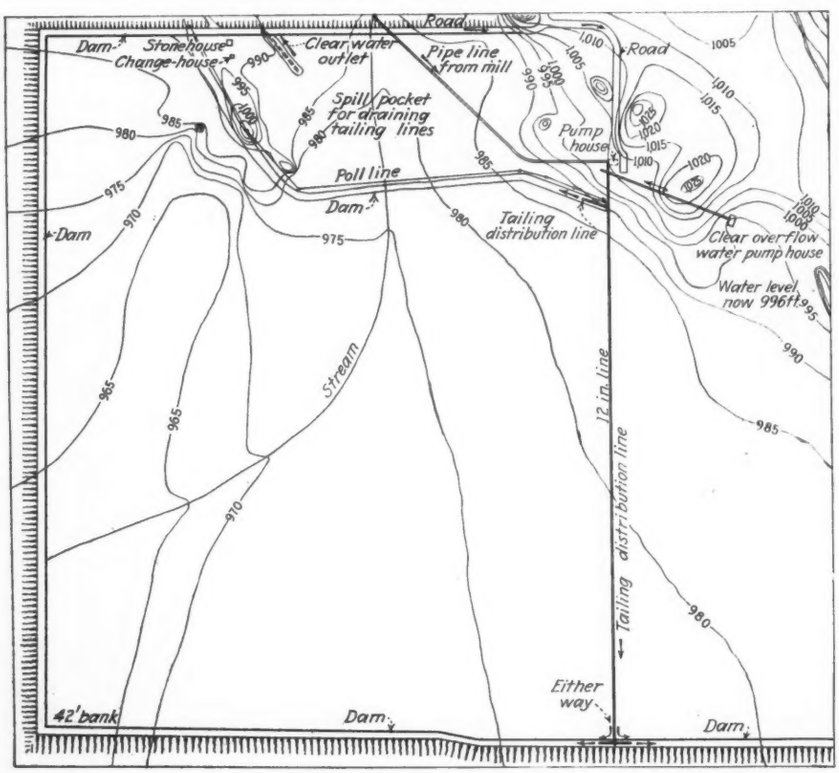
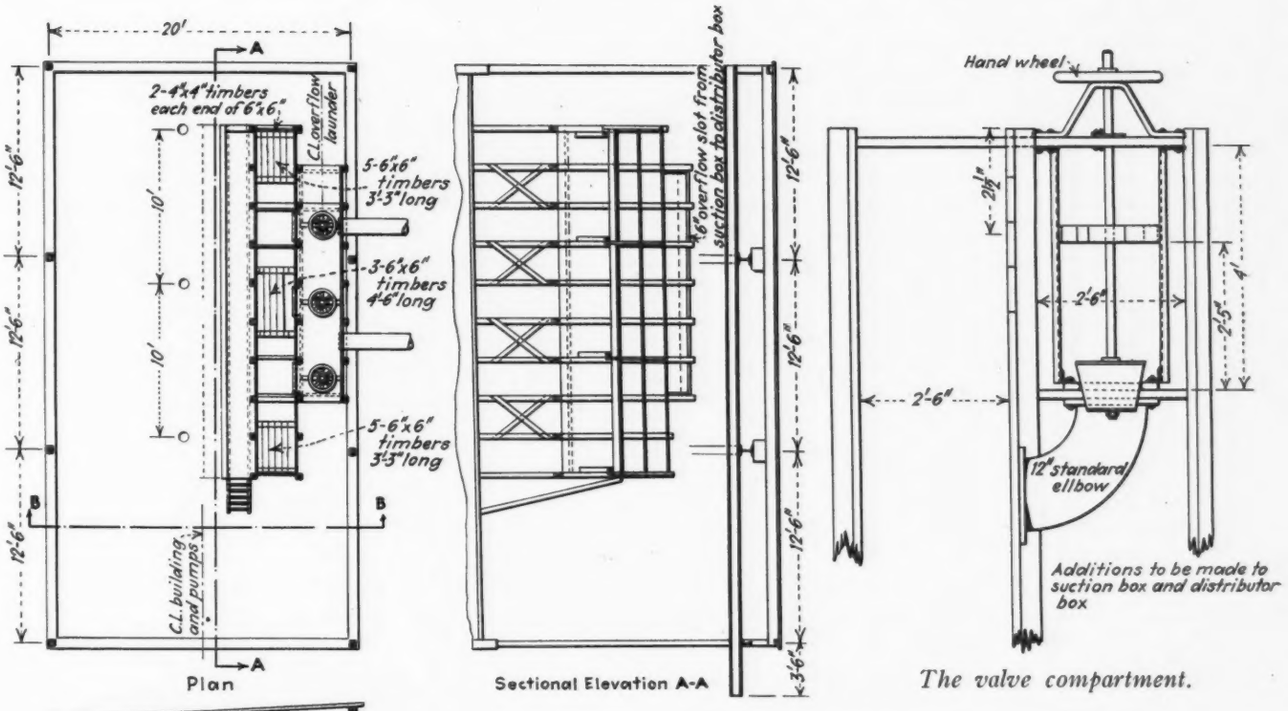


Fig. 1.—Part of the McKay claims on which the Hollinger company's tailing pond is situated. The left or western half of the tract was originally low, as the contours indicate, and its boundary swampy. Around this low portion the dam was built. The ground rises to the right. The eastern third of the tract is not shown.



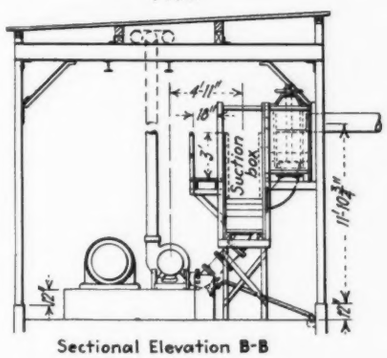


Fig. 2.— Pump station at pond. The arrangement of distributor and suction boxes is shown.

Two ways of impounding tailing may be considered. One is simple but effective for small tonnages only, involving as it does the erection of an earthern dam 8 or 10 ft. high, wholly or partly inclosing the tract of land, according to the topography, into which impounded area the tailing launder or pipe line discharges freely. This method has the defect that the coarse material settles out near the point of discharge and is not available for raising the dam in height, if this be desired later; also that the water and slime collects along the dam, with the result that eventually the barrier is subjected to a hydrostatic head equal to its height. When full, the pond must be abandoned and new acreage impounded. Where land is available and cheap, the tonnage small, and the mine prospectively short-lived such a procedure is justifiable. Obviously, it is unsuited for a company handling as large a tonnage as the Hollinger. The other method is to inclose a tract of ground with a dam and to discharge (or "spill") the tailing in such a way that the coarser portion will settle near the dam so as to be available for raising its height from time to time as the surface of the impounded tailing rises. This, in brief, is the method finally adopted by the Hollinger company, after considerable study, in the course of which particular attention was paid to the procedure developed by the Miami and Inspiration companies in Arizona. The experience of these and other operators afforded a valuable guide. It was necessary, however, to work out a scheme adapted to the latitude and to the particular material to be impounded. Climatic conditions necessitate that shoveling operations be completed before the frost has penetrated to such a depth as would make digging impractical. In this and a subsequent article a description of the company's present practice is given. Data and sketches were obtained through the courtesy of the management, and from E. L. Longmore and M. E. Williams, of the Hollinger mill.

The Site

To impound the Hollinger tailing an area of ample dimensions was needed. So a tract of land a mile long by half a mile wide, about 1½ miles from the mill, was acquired. The topography of this area, which is known as the McKay claims, is shown on the map in Fig. 1. It will be seen that the ground in general slopes from the northeast downward to the southwest corner, the latter point, with an elevation of 962 ft., being the lowest on the property. More than half of the area is below the 1,000-ft. contour. The maximum storage capacity of the tract was to be obtained therefore by erecting a dam along its southern, western, and northern boundaries to inclose this low-lying area, the ends abutting on the higher ground (now at the 1,014-ft. contour). Construction of a dam in this position was therefore undertaken.

The distance from the feed box at the top of the mill to the northern boundary of the claims, where the plan provided for delivery of the tailing to the tract, is 6,840 ft. and the drop 102.5 ft. The tailing will therefore flow by gravity to the tract.

To distribute the tailing around the dam for "spilling," pumping was necessary, as the gravity head was not sufficient to overcome the friction of the additional mile and a quarter of pipe used in these spilling operations. As it was desirable to make use of the full gravity head, the distributing pumping station was located at the highest possible elevation at which the lines from the mill would deliver the required volume. As the grade from the mill to the disposal site was fairly uniform, it

was decided to follow the natural ground elevations and raise the discharge end of the pipe to the desired height. Though this necessitated trapping the line, it was considered preferable to building some 3,000 ft. of trestle from 10 to 30 ft. higher than was necessary in the procedure followed. In addition to making full use of the difference in elevation of the mill feed box and the tailing site, the raising of the distributing pumps had the further advantage that natural drainage from the pumping station to the spill pond was provided.

The difference in elevation between the bottom of the feed box at the mill end and the discharge of the lines at the pumping station is 71 ft. The total length of the line is 7,870 ft. It was designed to deliver 1,130 gal. per minute (5,000 tons of solids per day) of a pulp having a specific gravity of 1.473—that is, 50 per cent solids—for tailing having a dry specific gravity of 2.8 and of a fineness as shown in Table I A on page 865. In operation one line has delivered 1,700 gal. (7,550 tons solids per day) per minute of pulp of the same character and dilution.

Two 12-in. wood-stave pipe lines were installed between mill and tract, and a pump station was erected on the latter at the point shown on the map. Details of this station are given in Fig. 2.

The Preliminary Dam

The dam site consisted of 4 ft. of muskeg underlain by 30 ft. of clay and sand—rather unpromising, it must be said. Plans called for building the dam of tailing. That which was normally discharged from the mill, however, contained over 70 per cent of minus-200-mesh material, and was quite unsuitable to use in starting and far too liquid. Something that would stand at a fairly steep slope was necessary. Satisfactory material was provided in the following manner at the mill:

Into a 30x10-ft. thickener 1,400 tons of solids (tailing) was fed each day with about 2,800 tons of water. This was classified by discharging a muddy overflow, the bulk of the slime being thus removed. The underflow, consisting of 600 tons of solids, at a dilution of 1 to 1, was pumped into an 8x10-ft. conical-bottom thickener, water being then added to raise the dilution to 2 to 1. Of this 600 tons, 150 tons was removed in the overflow of the second thickener and the balance, or 450 tons, discharged as a product having the following screen analysis:

Mesh	Per Cent
+ 48	2.56
+ 65	7.43
+ 100	16.10
+ 150	16.33
+ 200	7.46
— 200	49.50

This specially classified material was pumped through a 4-in. iron pipe extended over the line of the proposed dam on a 6-ft. trestle. The latter was built of small spruce trees except for the caps. Holes bored in the pipe at 45 deg. below the horizontal on its outer side, at 6-ft. intervals, permitted the uniform discharge or spilling of sand on the muskeg to the outside of the trestle. As the sand cones formed, men with shovels threw up a steep-walled bank, causing all further drainage to flow to the inside and building up a sloping pad of sand for use as a roadbed. As soon as the outer sand bank reached a height of about 4 ft. the trestle was ripped out. The outer face of the core now stood at an angle of about 45 deg., whereas the inner was almost flat, having a slope of about 4 ft. in 100 ft., the finer material flowing to inside and the coarser remaining on the outside.

With an electric dragline the muskeg and some of the spilled sand were now scooped up and piled on the sand core until the preliminary dam was 16 ft. wide at the top. After a week or more of draining and drying, this mixed bank was sufficiently firm to support the shovel in subsequent operations. This preliminary dam was built along all of the boundary which was swampy. Its ends abutted the rising ground at the 990-ft. contour (See Fig. 1).

Spilling

When the preliminary dam had been completed, the permanent spilling line, of 10-in. wood-stave pipe, was laid upon it within a foot or so of its inner edge. From this stage of the operation on, the procedure followed was quite like that pursued today. Present practice will therefore be considered in the remainder of the article. It might be added, at this point, that it was on June 5, 1925, that the tailing flow was diverted from Gillies Lake into the impounded area. At the present writing 6,500,000 tons of tailing has been impounded.

With the wood-stave pipe, spilling is effected through holes bored in the sides at 6-ft. intervals. Holes in the wood would rapidly increase in size owing to the cutting action of the sand, if no means were taken to prevent it. It is necessary, moreover, to control the size of the escaping stream, in order that proper classification may be made. Chilled cast-iron tapered spigots, or plugs, each having a longitudinal hole, are therefore inserted in the holes bored in the pipe. Spigots with $\frac{5}{8}$-in. holes are used in summer. This size of hole reduces the flow sufficiently to let the coarse sand settle out close to the dam, where it will be available for dam building. The summer spigots are also made long enough for one to grasp with ease, to facilitate insertion or removal.

A $\frac{5}{8}$-in. hole is too small for winter service, as it quickly fills with ice. In winter, therefore, spigots having $1\frac{5}{16}$-in. holes are substituted. These give a bigger flow, but do not freeze. They are shorter than the summer spigots, so that they will not project beyond the side of the pipe line. By keeping them within the pipe freezing is prevented. Details of the design of both spigots are given in Figs. 3 and 4. To remove a winter spigot a hook of special design is used. To avoid accidents from flying chips that would otherwise be broken from the chilled iron spigots, babbitt-headed hammers are used for driving.

Fig. 3.—Detail of summer spigot.

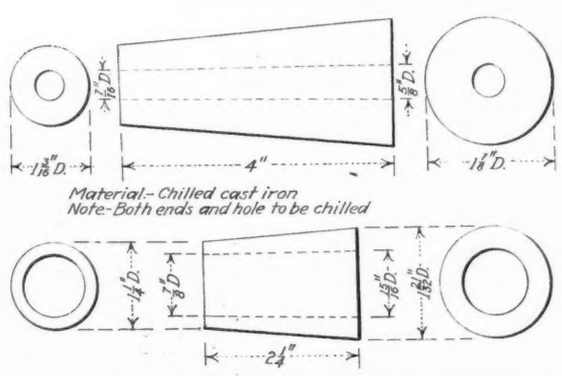


Fig. 4.—Detail of winter spigot.

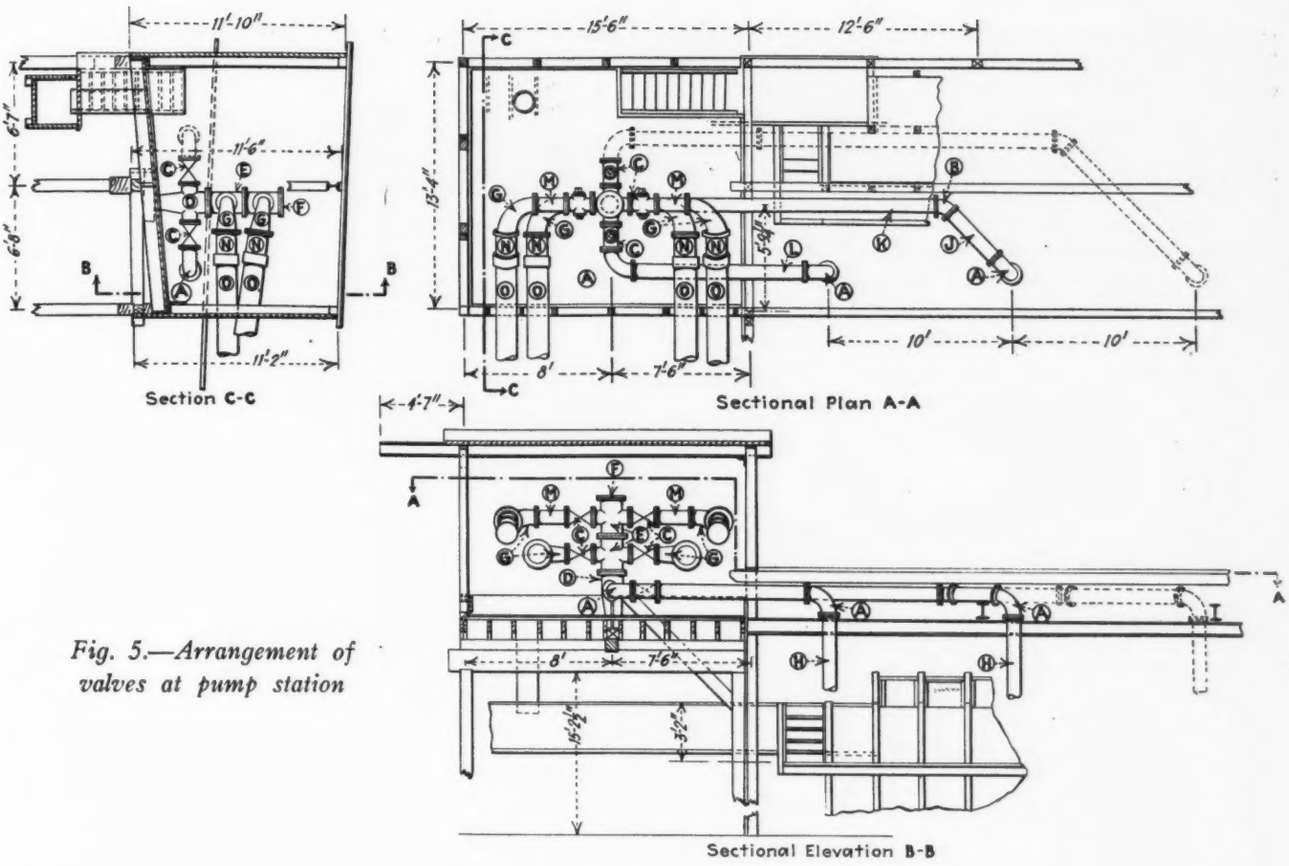


Fig. 5.—Arrangement of valves at pump station

Pipe List

Mark	No.	Mat'l	Description	Remarks
A	3	C. I.	8 in. std. 90° long radius flanged ell	Faced and drilled.
B	1	C. I.	8 in. std. 45° ell	Faced and drilled.
C	7	C. I.	8 in. std. flanged plug cock	Faced and drilled and with malleable iron nut.
D	1	C. I.	8 x 8 in. x 8 x 12 in. std. flanged side outlet tee	
E	2	C. I.	12 x 12 in. x 8 x 8 in. std. flanged reducing cross	Faced and drilled.
F	1	C. I.	12 in. std. blind flange	Faced and drilled.
G	4	C. I.	12 x 8 in. std. 90° long radius reducing ell	Faced and drilled.
H	2	Steel	8 in. std. pipe 11 ft. 8¼ in. long	8 in. std. screwed flange on one end. Thread other end
J	1	Steel	8 in. std. pipe 3 ft. 5 7/16 in. long	8 in. std. flanges.
K	1	Steel	8 in. std. pipe 15 ft. 2½ in. long	8 in. std. flanges.
L	1	Steel	8 in. std. pipe 9 ft. 4 in. long	8 in. std. flanges.
M	2	Steel	8 in. std. pipe 1 ft. 8 in. long	8 in. std. flanges.
N	4	Steel	12 in. std. pipe 1 ft. 6 in. long	12 in. std. flange on one end; other end not threaded.
O	...	Wood	12 in. wood stave pipe	
P	22	.....	8 in. gaskets	
Q	7	.....	12 in. gaskets	
R	176	Steel	¾x3½ in. bolt with hexagonal nut	For 8 in. flanges.
S	84	Steel	¾x4 in. bolt with hexagonal nut	For 12 in. flanges.

In spilling, alternate spigots only are allowed to flow at the same time, the others being stopped with tapered wood plugs. Thus the points of discharge are 12 ft. apart. Every two hours the flowing spigots are plugged and the alternate spigots opened. In this manner a cone is allowed to build up for two hours under every other spigot. Then the intervening space is similarly filled. In this fashion a continuous sand bank is built and channeling is prevented. If adjacent spigots are allowed to run at the same time the two streams are likely to unite and cut a channel.

It should be borne in mind that although a dam cannot be constructed out of whole slimes, neither can it be built, in the case of Hollinger, without some fines. A certain per cent of fines is necessary to prevent seepage from taking place too rapidly and the dam thereby becoming soft where this occurs. Sand alone would be too porous. Seepage would be to great and the dam would probably fail. It has been found desirable therefore, in this case, to take out only a certain per cent of the slimes in spilling.

The classification effected in spilling is indicated by a comparison of the screen analysis of the tailing as discharged from the mill with the analysis of a grab sample taken at intervals along the top of the dam. These analyses are given in Table I.

The marked decrease in the amount of —200 mesh material in the spilled tailing (Sample B), together with the proportionate increase in the amount of the coarser sizes, is to be noted. This classification of the tailing near the dam is important. It is necessary to remove a portion of the slime and finer sizes to get a material that will stand without flowing; also one that will drain sufficiently to be able to withstand the pres-

Table I—Screen Analyses of Tailing Showing Classification on Spilling

A — Sample of Tailing as Discharged From Mill,		B — Sample of Tailing Grabbed From Top of Dam,	
Mesh	Per Cent	Mesh	Per Cent
.....	.....	+ 35	2.80
+ 48	2.2	+ 48	5.82
+ 65	5.3	+ 65	10.90
+100	7.8	+100	11.33
+150	6.4	+150	7.68
+200	5.9	+200	6.75
—200	71.73	—200	53.99

sure, vertical and lateral, to which it will be subject. The spilling procedure for securing this will vary with every pulp, depending on its physical characteristics. The size of the spigot discharge must be varied until the stream is such that it will deposit the material desired. This can be determined only by experiment. It is also necessary to work out the proper interval between spigots to give a continuous sand bank.

Part of the water discharged from the spigots seeps away through the impounded tailing. The remainder, together with the unsettled slime, finds its way over the inward sloping surface of the tailing to the settling pool. It is desirable to keep the water level in the pool as far below the top of the dam as possible. On the other hand, the lower it is, the longer it takes to fill the pool. So it is necessary to strike a balance and work between about 5 and 10 ft. when completing the fill, the freshly raised dam being higher. At present it is about 10 ft. lower than the unshoveled portion, being at the 996-ft. contour (see map in Fig. 1). The dam is 52 ft. high above the muskeg at the southwest corner.

When spilling, it is necessary to maintain the velocity in the pipe line up to the point that will keep the pipe from choking with sand. A small discharge, about equal to that from four to ten spigots, is usually kept running out of the end of the line. On this end is a 90-deg. elbow with an extra length of pipe extending toward the pool. By raising this end of the pipe at varying angles, the pressure on the spigots may be correspondingly varied.

Spilling is customarily done over a 1,200-ft. section of the pipe line at a time. With alternate spigots being run, this would mean that 100 spigots would be flowing at once in this length. Practically, however, it is unusual to have more than 85 or 90 flowing at the same time, the others being alternately plugged to keep up the velocity in that part of the line beyond the point where building is being carried on. Spilling is continued over one section until the tailing is within about 6 in. of the pipe line. After it has been done along the whole boundary, and the dam is fairly level for the entire length, the operation is resumed at the starting point and continued until completed.

When spilling has been completed over a 1,200-ft. section, the spigots are plugged, and spilling is begun on another section. In the meantime, the newly deposited tailing on the former section is left to dry. By referring to Fig. 1, and also to Fig. 5, which shows the arrangement of valves and piping in the pump station, it can be seen that the tailing can be sent either to the northeast, northwest, southwest, or southeast sections of the dam, as desired. The line running directly south from the pump house across the pond (Fig. 1) is for distribution and not for spilling except when necessary to spill a new sand base for use in raising this trestle and when spilling around the dam has been completed. To allow the last section spilled sufficient time to dry before beginning to raise the height of the dam, this distribution line (which feeds the southwest and southeast sections) is broken in the middle and the tailing allowed to discharge freely from the end. Before beginning to shovel, the wettest tailing spilled around the dam will have had time to dry for at least one month and some of it for three months.

Normally, spilling is done ten months in the year. It was completed this year in June. Building or raising the height of the dam was started on July 28 and was completed by the middle of October. Spilling is resumed as soon as a sufficient length of dam has been built along a boundary to allow both operations to take place without interference. As the area within the dam enlarges (as the abutments climb the hill), the volume per foot of height increases, so that tailing can be spilled for a longer period before building becomes necessary. Earlier, especially at the start, building followed closely on the heels of spilling, so that the sand for building did not always have sufficient time to dry. The dryer it is, the higher it is possible to raise the bank at one shoveling, and therefore the cheaper it is to build. It is now possible to raise the entire boundary for the year in one round of shoveling. Building (or digging) has been done even during January (the dragline cab is insulated against cold), although the frost cakes become very difficult to break by this time. Freezing at night sets in usually in October, with general freezing in early November.

(To be concluded)

Longer Life for Crossties

TIMBER that is properly treated and not subject to mechanical wear can be said to possess permanence in the practical sense, according to *Wood Preserving News*. Crossties present a different problem. The mechanical life of a properly treated crosstie is less than its physical life, and it has been the custom only to give the tie sufficient preservative treatment to insure a physical life equal to its mechanical life. A crosstie kept sound by preservative treatment offers greater resistance to mechanical wear than an untreated tie weakened by decay. Recent studies show that mechanical wear is due to motion of track parts and that the extent of wear is dependent upon types and sizes of fastenings and methods of their application. Here would seem to lie the basis for development of a remedy for mechanical wear.

A Glorified Baghouse

TWO forms of dust- and fume-collecting equipment are in general use in modern metallurgical works. One is an electrostatic precipitation process adapted to corrosive gases, and the other is the baghouse. A third, and simpler, form of equipment might also be mentioned—the plain balloon flue.

Baghouses have been generally accepted as necessary nuisances in lead-smelting plants and where similar problems have to be solved. They have disadvantages, however, as any one who has ever worked around one of them knows. The first real advance in baghouse construction was made a few years ago, with the design of equipment by a Cleveland company that, although based on the principles of the baghouse, obviates its disadvantages and, in a minimum of space, secures almost perfect clearance. The vice-president of a lead company that has made two installations of this filtering apparatus will tell us about it in an illustrated article to appear in an early issue.

Novel Method of Sublevel Stoping

By R. B. WORTLEY

Chief Mining Engineer, M. A. Hanna Company, Iron River, Mich.

THE following paper discusses the sublevel stoping method employed by the Hanna Electric Furnace Company, operators of the Carpenter and Monongahela mines, near Crystal Falls, Mich. The method involves the filling of the stoped-out areas as soon as the ore has been removed and the use of bulkheads to keep the sand, gravel, and water from entering the mine.

The Carpenter orebody consists of a broad concentra-

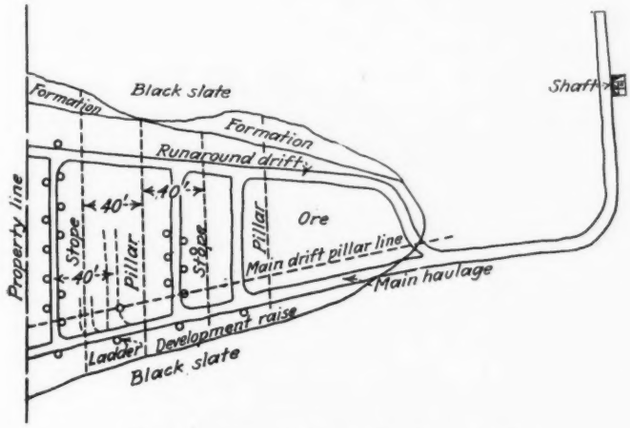


Fig. 1—Plan of main haulage level

tion, filling a westward pitching trough, with an average length of about 500 ft. and a width of about 300 ft. The surface material, which has an average depth of about 175 ft., consists of fine sand, gravel, and a little hardpan, through which varying amounts of water pass.

Alfred Martin, superintendent, and Robert Creer, captain, as a result of the trouble and expense caused by the unexpected caving of the old open stopes, which allowed sand and water to enter the mine, developed the present system.

The haulage levels, about 150 ft. apart, are driven near the contact between the ore and the side walls of the trough, and extend the full length of the orebody. The first crosscut is started 25 ft. from the boundary line and runs through the center of the first stope area. Other parallel stope crosscuts are driven at 85-ft. centers from the first crosscut, and, later, pillar crosscuts are driven between the stope crosscuts to recover the ore left in the pillars between the stopes.

Stopes and pillars are laid out from one wall to the other at an angle of 90 deg. with the main haulage drifts, all stopes and pillars being 40 ft. wide. The stope areas are developed first by raising the first chute raise the full height of 130 ft. to accommodate the development material. A ladder raise is also carried up at the same time, tying the two together with drifts on the elevations of the various sublevels. The first sublevel is 30 ft. above the haulage or main level, and succeeding sublevels are spaced 25 ft. apart to a height of 130 ft. This arrangement places the top sublevel 20 ft. below the old or worked-out haulage level. Inasmuch as upper holes are not drilled or blasted from the benches on this sublevel, it leaves a protecting floor or back pillar about 15 ft. thick over the stope. All sublevel drifts and crosscuts are driven directly over the main level layout, but are much smaller in size than the corresponding openings on the main level.

Chute raises staggered along the crosscuts and spaced at intervals of 12 to 15 ft. are put up to the elevation of the 30-ft. sublevel, and are later belled out as the stoping operation retreats in the direction of the haulage-level pillar line. The stoping operation is started at the point farthest away from the haulage drift by putting up a starting raise to connect the ends of all the sublevels. Benches are then started around this raise, beginning on the lower sublevels; the broken ore falls through the raise and is drawn through the chute at the bottom.

To protect the miners working on the lower sublevels, the retreat of the lower sublevels is kept in advance of the retreat of the upper ones. This method gives an overhanging working face that protects the miners from chunks falling from the upper sublevels.

The benches start from the development crosscut and are driven as far as the pillar line. Next, upper holes are drilled to a depth of 8 to 10 ft., and the back is blasted down; then, starting from the pillar end of the bench, lower or stope holes are drilled and blasted for

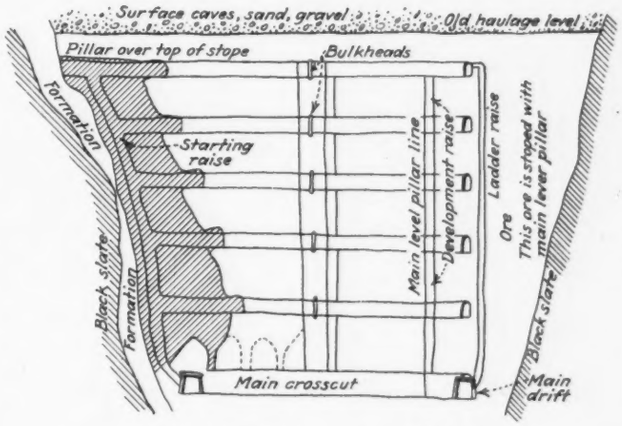


Fig. 2—Longitudinal section through stope

the purpose of knocking down the bench. A new bench is then started from the development crosscut.

Stoping operations are continued until the back of the stope shows signs of weakening, at which time bulkheads are put in on each sublevel, and a mat of ore is left in the bottom of the stope. The purpose of the bulkheads is to keep the sand and surface material from

Abstract from paper read before the Lake Superior Mining Institute, Sept. 7, 1928.

filling up the sub-drifts, while the mat of ore in the bottom protects the main-level haulage drift. The bulkheads are constructed of timber and have a small door through which entrance to the stope can be gained.

The bulkheads are above each other in each sublevel at a point where it is thought that stoping operations can be carried on before the stope caves through the back. If after two or three days the stope does not come in, entrance is then made through the bulkheads,

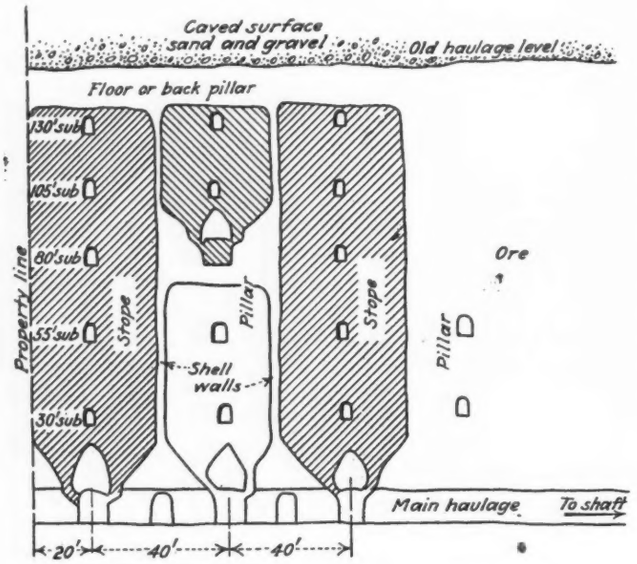


Fig. 3—Cross-section through stope and pillars

and another bench is mined out, carrying the working face to within 5 ft. of the line of bulkheads. Then, if the stope does not come in after a short period of time, long holes are drilled in the back pillar from the 130-ft. sublevel and are heavily charged with dynamite. After all the bulkheads are closed the firing is done with electricity.

The back of the stope usually gives way after the first blast, and the stope fills. Any water present gradually drains through the bulkheads and from the chutes in the bottom of the stope. The floor or back pillar drops on top of the mat of ore and is later drawn through the chutes until the dilution from sand prohibits further drawing of this material. A new starting raise is then put up just back of the bulkheads; and stoping operations, as above outlined, are continued until the retreat has reached the haulage-level pillar line.

After a stope on each side of the pillar area has been mined and caved, the pillar area is developed in the same manner as the stope area, the only difference being that 80-ft. sublevel drifts are driven large enough to accommodate chutes and sublevel transfer cars.

A back pillar above the 80-ft. sublevel through which the chutes pass, and a 10-ft. floor pillar under the sublevel are left to support the side walls. This is more easily understood by referring to the longitudinal sketch of the orebody. The stoping operations are started at the far end, and, as the stope retreats, test holes are carried along the side walls to determine the position of the sand in the filled stopes. Instances have occurred where the stopes have been filled with wet, sandy material containing some clay, and then have been allowed to stand for a period of a year or more. When the pillar ore is being mined from between these stopes a clean job can be done, the dried sand and clay remaining in place without support from the ore. Where the material in the previous stopes is not firm, it is necessary to leave a thin-shell wall of ore to hold it back, the width of this shell wall being from 3 to 5 ft. thick.

The ore above the third sublevel is stoped out first and is transferred through one raise at the end of the drift to the haulage level below. After this area has been caved, the ore below the third sublevel is stoped, as described above, the ore being removed through a crosscut from the main-level drift.

After the stopes and pillar areas have been mined out, the triangular-shaped areas left between the main crosscuts are scrammed to the elevation of the haulage level, thereby recovering all the minable ore to that level. During the operations care is taken to keep the development of new areas far enough in advance to spread the development charges evenly over the monthly productions.

In the method described in the foregoing the direction of retreat is usually from the weakest wall. This method has an advantage over the open-stope method in that one can control the caving of the surface by filling the stoped-out areas as the ore is removed, thereby avoiding danger of surface caves at times when they would cause damage.

Placer Possibilities in Eastern Alaska Discussed

GEOLOGICAL conditions are favorable to the occurrence of placer gold in paying quantities in part of that region in Alaska which lies north of the Tanana River and near the Canadian border. This opinion is based on the findings of members of a U. S. Geological Survey party which last summer made a reconnaissance in that territory and which is now back in Washington preparing its findings for publication.

The region examined is south of the Yukon and west of the international boundary. The party that examined this tract followed the general route of travel down the Yukon to Eagle, the first settlement on that stream in American territory. At Eagle the party, which had brought in with it a pack train of five animals, struck into the country south of the Forty Mile mining district, in which many rich finds were made during the early days of the Alaskan gold rush. This party found much territory in this back country that is geologically similar to that in which the former paying deposits had been found. It seems, therefore, that the chances of finding gold in paying quantities here are as good as they were in some of those regions where deposits were profitably exploited.

Much of this region is described as consisting of large bodies of granitic rocks which seem to present few possibilities of gold in paying quantities. Along the margins of such intrusive rocks, however, and more particularly in the vicinity of smaller outlying intrusive bodies, are more favorable sites for prospecting. The geologist who is making the present study will definitely place the granite areas on the maps and indicate any areas that are regarded as favorable for prospecting. The advantage to the prospector will lie in the fact that he will be directed to the regions which, from a geological standpoint, offer the greatest probabilities of success, and away from those that offer little chance of returns. This is conservation of both capital and labor.

USEFUL OPERATING IDEAS

Weakening Post by Housing Avoided

IN TIMBER construction, the weakening of a post by housing or gaining, in order to furnish a bearing for short pieces, or corbels, bolted to it as supports for horizontal members, may be avoided by bolting the corbel to the post without housing and then boring two holes on the contact of the two faces and driving short lengths of pipe or hardwood pins into the holes to serve as shear members. The device is shown in the accompanying photograph. The holes are thus half in the post and half in the short piece of timber. In the case illustrated the holes are 1½ in. diameter. The outside diameter of the pipe or pin should be the same as the diameter of the hole, thus insuring a tight fit. It is necessary that the corbel be kept bolted tightly to the post. The plant shown is that of the Porcupine Paymaster company, at South Porcupine, Ont.

Corbel secured to post without housing

The device is not new, but is deserving of wider application. It was employed extensively in the construction of the buildings of the Panama Pacific Exposition. On that occasion imported hardwood pins were used.

Hauling 10-Ton Cars on a 20-Inch Track

TEN-TON cars have been used successfully in underground haulage at the Morenci Branch of the Phelps Dodge Corporation for thirteen years, according to C. G. Grimm, acting transportation foreman. These cars are of the gable-bottom, side-dumping type, equipped with automatic air brakes, M.C.B. couplings, and journal bearings. The volume of the 10-ton car is 200 cu.ft., with outside dimensions of body as follows: 11 ft. 6 in. long, 5 ft. 4 in. wide, and 4 ft. 4 in. high. The height of the car on trucks is 5 ft. 9 in. Length over all, including drawheads, is 14 ft. 6 in.

The entire system of track on the main-haulage level consists of 48-lb. and 50-lb. C.F.I. rails on 20-in. gage with maximum grade of 0.4 per cent in favor of the load. All the curves in the track are simple, with a minimum radius of 80 ft. Where possible, curves of longer radius are put in.

Ore at Morenci was originally transported in 5-ton cars, but it was thought that cars of a capacity of 10 tons would have several advantages. When 10-ton car haulage was established it became evident that a larger volume of ore could be hauled at a lower cost. It soon became apparent that to haul 10-ton cars with a 5½-ft. wheelbase over a 20-in. gage track, with short-radius curves, involved a problem in track maintenance. The success achieved has been due to maintaining a level road bed, to retaining the proper gage on the short-radius curves, and to continuous inspection and repairs to switches and rolling stock.

Owing to the large overhanging load that extends on each side of the track, the cars must be loaded evenly to prevent swaying motion of the loaded train during its trip to the shaft. To overcome this motion as much as possible, the straight track must be kept absolutely level and the track ballast must be kept dry and firm.

When a 10-ton car travels around an 80-ft. radius curve, the trucks, which are rigid, are moving in a cramped position. The outside front wheel is thrusting and binding against the outside rail of the curve while the inside back wheel repeats the operation against the inside rail. This naturally causes excessive wear and strain on the rails of the curve. To relieve this as much as possible, the maximum gage of 21 in. is used on the curves. This gage still allows the necessary 2-in. traction surface for the inside wheel. It is important that the gage does not become more than 21-in. To insure this, every curve is inspected and tightened frequently.

The outer rail of an 80-ft. radius curve is given 1½ in. of super-elevation at the center position of the curve, and is tapered off to level at each tangent point. The arbitrary 1½ in., which is the maximum allowable super-elevation for an 80-ft. radius curve on a 20-in. gage track, has been determined here by experiment.

It is readily seen that in order to haul ore in 10-ton cars over a 20-in. gage track successfully and economically, all track must be laid properly and kept in perfect condition.

Spillage-Handling Cheaper With Elevator

SPILLAGE was the bugbear at one of the cyanide plants in the Kirkland Lake district at one time. The centrifugal pump handling the spillage from the sump would be frequently choked with chips and refuse. Other plants in the district were using a 30- to 40-ft. stage elevator requiring a launder. To install this would have entailed some expense. A compromise was finally decided upon by installing an 8-ft. elevator with 6-in. buckets. This elevated the spillage to a screen, where oversize and chips were removed. The material passing through the screen flowed into a tank, from which the original centrifugal pump was fed under an 8-ft. head. No more trouble was experienced. The pump discharged directly to a classifier. Not only did this expedient save expense, but it was easier to find headroom for a pipe line, required by the pump, than for a launder which a stage elevator would have necessitated.

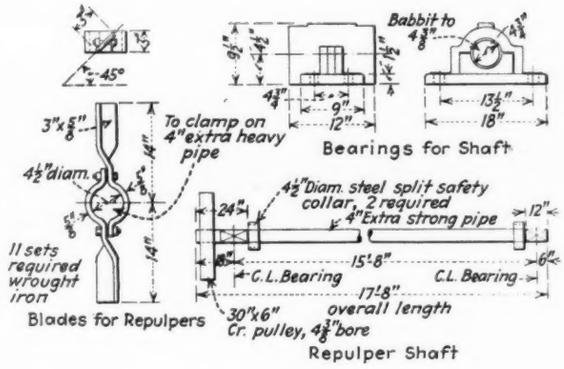
Pump Follower Plate Lined With Rubber

THE white iron follower customarily used on the Wilfley pump lasts only eight days on the average under the conditions to which it is subjected at the cyanide plant of McIntyre-Porcupine Mines, Schumacher, Ont. A way of securing longer life has recently been devised by J. J. Denny, mill superintendent. After turning down the face of the follower until it was smooth, he mounted on it with wood screws a disk liner made of 1-in. rubber ball-mill lining, the fiber side being placed against the metal. The wood screws were driven from the metal side. A follower thus lined with rubber lasted 97 days before it was taken out of service.

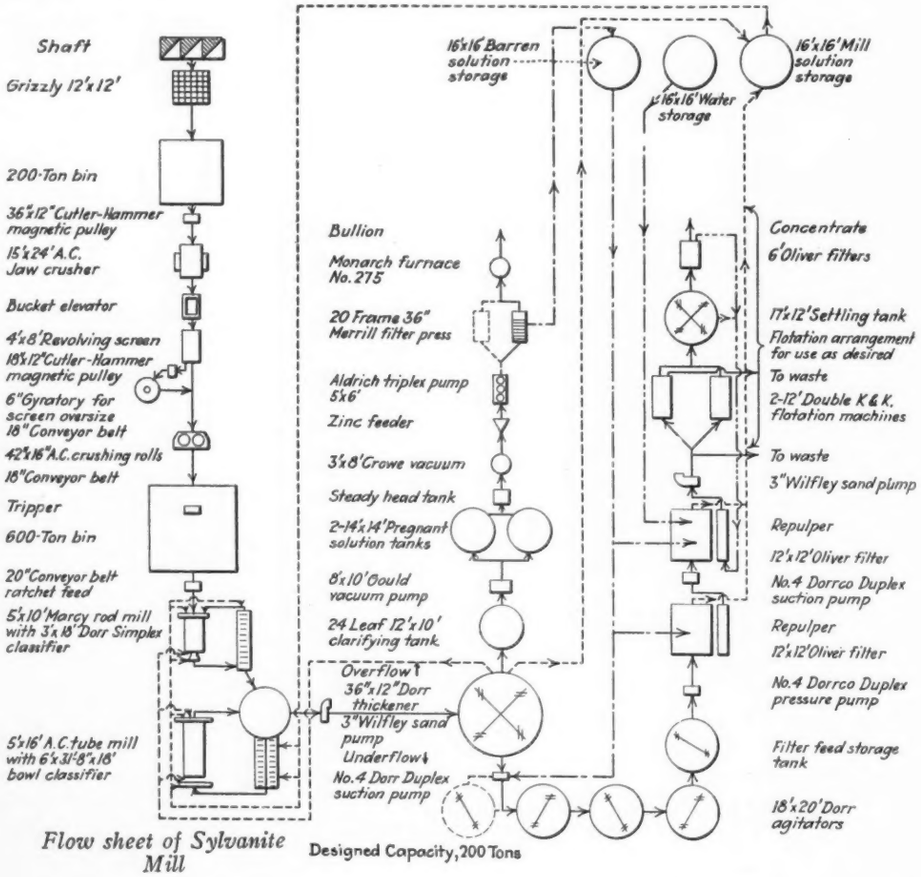
Repulping Filter Tailing Advantageous

N THE flow sheet of the Sylvanite Gold Mines, Ltd., Kirkland Lake, Ont., which is shown in an accompanying cut, it will be noted that after the pregnant solution has been drawn off the pulp in the 36x12-ft. thickener, the pulp is discharged to four 18x20-ft. agitators in series and from them into the filter feed storage tank. From this tank the pulp is pumped to a 12x12-ft. Oliver filter. The filtrate is sent to the mill solution storage tank and the filter tailing is repulped. The design of this repulper is shown in one of the accompanying illustrations. After being repulped, the tailing from the first filter is sent to a second 12x12-ft. Oliver filter, the filtrate from which is also sent to the mill solution storage tank, and the tailing of which, after being repulped, is discharged to waste:

In operating the filters on the basis of 195 to 200 tons per 24 hours, the following quantities of wash water are said to be used. (The fineness of the slime product is rated as 97 per cent minus 200 mesh):



Details of repulper shaft, blades, and bearings



Flow sheet of Sylvanite Mill

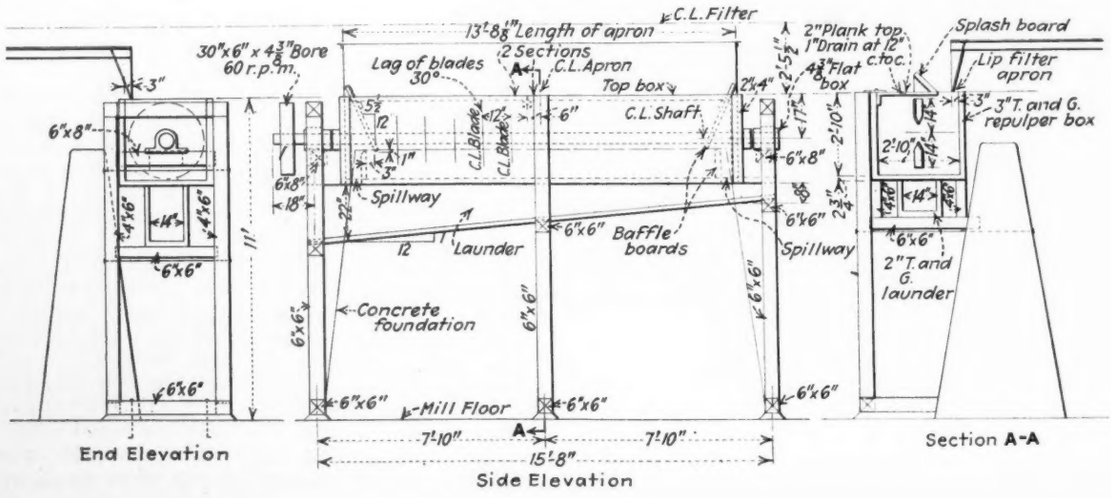
Tonnage of Wash Water Used in Filtering

	Tons Per Hour
Barren wash on first filter	4.5
Barren wash added to repulper	2.3
Barren wash on second filter	0.7
Wash water on second filter	2.64

Tailing is discharged at 45 per cent solids and is elevated by means of a Wilfley pump.

The design of repulper shown requires low headroom and permits the pulp to be kept away from the shaft bearings. The effect of repulping is reported to be very good, costing little for power and upkeep.

Expressed in percentages, the value of the soluble loss in pulp discharged from the second filter is 0.19 per cent of the value of solution entering the first filter, and the value of the solids discharged from the second filter is only 27 per cent of that which they contain when entering the first filter. From these relationships it is evident that good washing is accomplished, and at the same time a notable dissolving effect is being obtained on the two filters. The dissolved value in the final tailing is reported to be low.



Side and end views of repulper box used at Sylvanite mill

COMMENT AND CRITICISM

Suggestions for the Location of Mineral Claims in Mexico

Complexities of Law and Frequent Changes in Ownership Make Thorough Examination of Title and Surveying of Property Necessary to Avoid Constant Litigation

To the Editor of "E. & M. J.":

Although it refers to a special case of location of mining claims in Mexico, I am inclosing a copy of my preliminary report on the Vacas camp, in the State of Durango. A good many owners of Mexican mines have been so careless as to allow locations of their mining claims to "sleep" until litigation is started. Even then, they usually go to a lawyer, who, examining the titles, may find them correct in all the legal requirements and therefore pronounces them valid. He knows nothing about the technicalities of surveying. The surveyor, in turn, ignores the little "kinks," interpretations, and constructions of mining titles. The result is an entanglement, discovered too late, that occasions the outlay of thousands and even millions of dollars. A mining title that is approved of by a lawyer may be condemned by a surveyor; and a surveyor without any legal knowledge may be handicapped thereby and prevented from doing the correct location work. It seems to me that law, geology, and applied geometry ought to shake hands for the purpose of keeping both large and small mining investments out of litigation.

REPORT ON THE VACAS CAMP

In making a report on the location of mining claims in the Vacas camp, Parilla, Nombre de Dios, State of Durango, Mexico, the following points were taken into consideration:

1. It is always important for mining companies to know the location of all mining claims in the camp where they are operating. There may be no question as to the titles of the various properties themselves, but it must be remembered that many old surveys were so badly made that, as a general rule, the location on the ground never coincided with the one shown in the title.

2. As a result of this condition, all important mining companies should undertake accurate surveys of their mining claims. These can serve for other purposes, also, related to the geological study of the camps and to actual mining operations.

3. Such a survey establishes the points of topographical control for the establishment of location and boundary monuments, as is now required by the Mineral Industries Law. Points on which future surveys shall be based are thus fixed.

Old mining claims, denounced and patented under mining legislation prior to 1892, have no title number, unless resurveyed after 1892. However, they are recognized by the number under which they were originally registered for taxation purposes. This number and the date of the "acta de possession" define those claims.

After 1892, titles were issued with numbers, which identify the properties to which they refer. To each property there is also an "expediente" or record. The "expediente" is finished when all the legal requirements for patenting the claim have been fulfilled, and the title is issued thereupon. However, the title number suffices to define each claim. Properties declared "caduca," or forfeited upon default of payment of mining taxes, are marked with a C, and the ground is free.

In making a survey, the first point to be established is the point of departure. From this, the boundary line is surveyed, always as a closed traverse. In every mining camp there are several mining claims, called "key claims," each having independent points of departure, generally an old working on the outcrop of the orebody. These points of departure are now accurately located by means of what the Mineral Industries Law calls a location monument. Points of departure or location monuments are also tied to each other by means of the accurate general triangulation survey. Generally, the points of departure of the "key claim" or its corresponding location monument is situated within the boundary line of the claim, and is tied to the boundary line by distance and bearing to one of the boundary monuments, which, as their name implies, are the monuments built in the corners and along the boundary lines of a claim.

Some other mining claims are tied direct to each "key claim," thus forming a rigid group of claims. By means of accurate ties between the location monuments of the various "key claims," it is possible to determine if the groups overlap each other, or if there is free intervening ground and its accurate area. This free intervening ground serves for the locations of what may be called tying claims.

As soon as exploration develops rich orebodies, costly and ruinous litigation usually starts on the excuse of conflicting location of mining property. Old surveys are all wrong; ties were never used. If no investigation based on accurate survey work precedes the construction of new monuments, as required by the present legislation, the companies involved are open for trouble.

Both location and boundary monuments shall be built in masonry, as follows:

Location Monuments—There is one to each "key claim," and consequently one to each group of claims built on the points of departure of the "key claims." Height is 1 m., square section, 0.60 x 0.60 m. It has a flat, horizontal top with a 1 in. pipe stuck in the center. Location monuments are numbered after the "expediente" number of the corresponding "key claim." The location monuments are either triangulation stations, or are accurately tied to the triangulation system by means of sights to three triangulation stations. If no three stations can be sighted, then a closed traverse to two triangulation stations is used.

Boundary Monuments—These should be built on corners and along boundary lines. No special limitations exist as to size. It is advisable to build them in a conical form or truncated pyramid, at least 1 m. high, with initials, color or shape to distinguish them from the boundary monuments of other properties. It is important, in the course of a survey, to "tie up" a boundary monument now and then to the points of control of the triangulation system for checking purposes.

In my report I submitted the following propositions:

1. A triangulation survey should be made covering the entire mineralized area of the Vacas camp.

2. Field notes, calculations, and maps should be turned over to companies interested in the camp and a complete report delivered to the Mines Department in Mexico City, so that the general survey may be approved officially.

3. Permanent marks should be built for all triangulation stations so that the Mines Department may order future surveys tied to the triangulation points of control.

4. Location monuments of all groups of mining claims should be accurately tied to the triangulation system by means of sights to at least three triangulation stations or by means of closed traverses tied to two triangulation stations.

5. Location monuments should be built

on the proper points in the manner prescribed by the law.

6. Boundary monuments should also be built along the right boundary lines and in every corner, in the manner prescribed by the law.

7. A general claim map of the Vacas camp should be drawn, showing all details of location and all monuments, buildings, and salient topographical features.

8. The above map, with a report, should be filed with the Mines Department, Mexico City.

9. Also, the above map may be used, if so desired, as a foundation for a geological map of the camp.

ALBERTO TERRONES BENITEZ.

Mexico, D. F.

Kentucky Had Its Geologists More Than 100 Years Ago

To the Editor of "E.&M.J.":

A fact that has perhaps escaped the observation of many American geologists and engineers is that some of the earliest geological sketches on Kentucky and this portion of the Mississippi Valley were published more than 100 years ago in the *Western Review and Miscellaneous Magazine,* of Lexington, Ky. These writings, presenting a combination of sketchy reconnaissance observations, coupled with somewhat fanciful deductions, came principally from the pens of Constantine Schmaltz Rafinesque, of Transylvania University, and his friend, John D. Clifford, of Pennsylvania. The publication of these items in Kentucky in 1819 and 1820 is little short of a marvel when one considers that at this time William Maclure, of Philadelphia (1817), Benjamin Silliman, of New Haven (1818), Amos Eaton, of Albany (1818), and Samuel L. Mitchill, of New York (1818), had scarcely released the first descriptive publications in American geology.

No need exists to delineate here either the character of the eccentric Rafinesque or his writings, because both are well known. Little is now available, however, concerning Clifford, except that he was a retired, English-born, Philadelphia merchant of means, with a taste for nature investigation, particularly in the field of geology and geography. It was as a result of his personal solicitations, Collins indicates, that Kentucky and Lexington in particular secured the services of their first professor of natural science. Had he done nothing more than this to quicken the flame of early scientific investigation in the Western country Clifford would deserve a wide acclaim and recognition, which it appears a greatly benefited posterity has been slow to accord.

Rafinesque wrote a fragment or two touching on Clifford to which the editor of the *Western Review* added a brief obituary. Clifford was a member of the "Academy of Natural Sciences" of Philadelphia and the "Antiquarian Society of Massachusetts," according to Rafinesque. He owned fine antiquarian and natural history collections, and was on various occasions a resident of Lexington, Ky. After completing one or two trips through the Western country, he died in his 42d year on May 8, 1820. The June number of the *Western Review* carried as its initial article his paper entitled "Remarks on the Geology of the Valley of the Mississippi." As the first of a series of articles planned by Clifford to describe his travels, "these lines had hardly been in type, when Clifford was suddenly lost to his friends and science," to quote the words of Rafinesque.

There appeared in the succeeding number of the *Western Review* a second of Clifford's articles entitled, "Remarks on the Geology of the Valley of the Mississippi No. 2." This, his last piece of geologic writing, is introduced with a few short paragraphs by Rafinesque, after which follows an outline of the route traversed by Clifford during his geological and mineralogical observations.

At the same time Rafinesque, while spending the greater part of his time in Kentucky and the Mississippi Valley, was writing on many subjects, particularly the "Fishes of the Ohio River" and Indian relics and remains of the Bluegrass region, principally of Kentucky. In the *Kentucky Western Review* magazine, Rafinesque, then professor of botany in the natural history department of Transylvania University, contributed an article that is remarkable for accuracy and detail, considering the time in which it was written, and indicates the exact acquaintance which Rafinesque must have had either through travel or the personal experience of others throughout the Ohio Valley, and particularly that portion of it which is found within the boundaries of Kentucky.

WILLARD ROUSE JILLSON.

Frankfort, Ky.

A Metallurgical Millennium

To the Editor of "E.&M.J.":

Many unsuccessful attempts have been made to find an economical process that would treat refractory ores. Some of these attempts met with partial success and others with total failure. It is therefore of great interest to all who are contronted with this difficulty to know that a machine has been invented and patented by which all ores of this character can be easily and economically treated; the results obtained from practical demonstrations exceed all expectations, inasmuch as the yield in gold is extraordinary compared with results from former methods.

Unlike the general ways and means adopted for the extraction of the gold, the ore is first ground, then placed in the machine and subjected to a chemical treatment under great heat, by which the metallic compound crumbles, and the different metals separated and released, the various volatile metals being driven off into condensers and are saved, leaving the gold and silver free in the ore, which can readily be recovered by cyanide, chlorine, or amalgamation.

Another important feature is that the machine can be taken to and erected upon any mine accessible by road, and where wood, coal, oil, gas or electricity can be had.

GEO. W. B. EVANS.

Kensington, Md.

An Example of Prompt Co-operation

In the issue of Nov. 17 a letter was published from a correspondent in California, requesting the address of the sponsors of the Enzlin-Eklund platinum-gold amalgamation process. Through the courtesy of Mr. L. L. Bolton, assistant deputy minister of mines, Ottawa, Canada, the information was mailed from there on Nov. 20. A copy of Mr. Bolton's letter is appended for the information of others who may be interested:

Ottawa, Nov. 20, 1928.

Mr. John L. Campbell,
San Bernardino, California.

Dear Sir:

Your letter to the editor of the *Engineering and Mining Journal* on page 796 of the issue of Nov. 17, 1928, has come to my attention. In case it may be of use to you, I may say that we have been in communication with Mr. Eklund to whom you refer and his address was

Mr. John Eklund,
P. O. Box 124,
Pietersburg,
Transvaal, South Africa.

Yours sincerely,
L. L. BOLTON,
Assistant Deputy Minister.

New Cobalt Field

To the Editor of "E.&M.J.":

Arizona can boast of the best and perhaps the only real cobalt field in the United States. The veins are from 1 in. to 3 in. thick and the ore assays from 29.45 per cent to 49.15 per cent cobalt. They carry enough bismuth, gold, silver, aluminum and arsenic to meet all mining expenses without the cobalt. As yet the owners of the properties have done nothing but prospect, but the public must soon know of the great find. Cobalt producers will no doubt be anxious to know of the find, as cobalt fields are a rare find, especially in large quantities. Enough cobalt lies in the earth to supply the United States for many years if the prospect holes tell any kind of a story. Arizona is the land of possibilities and is still young in the mining game.

S. F. WRIGHT.

Show Low, Ariz.

READERS of "E. & M. J." are respectfully asked not to send in anonymous communications. Unless letters to the editor can be identified and their import, if there be any, made a matter of record, they will not be published. The writer's identity will be suppressed, if the request to do so be made, but the name and address of the correspondent must always be given.

INDUSTRIAL PROGRESS

The Equipment Review

New Model of Centrifugal Air Separator Has Greater Efficiency and Capacity

PROMINENT among the equipment recently introduced for service in the mining and metallurgical field is an improved air separator, operating on the centrifugal principle, which has been brought out by Rubert M. Gay Company, Inc., 114 Liberty St., New York. This is known as the Model 27 Gayco centrifugal. In it are embodied ideas gained by the company in its eight years of experience with an earlier model No. 21. The new separator operates on the principle of separating by centrifugal force instead of by gravity, the force being generated in the particles to be separated by revolving vanes in the separating chamber. Any rotating device in the separating chamber that increases the slight natural whirl found in all air separators is covered by the company's patent.

The weight of the new model is greater than in previous similar devices; angles and channels have been added to the outer shell to facilitate erection and prevent damage in transit; the angle of the conical section has been increased, and flat shelves under the deflectors have been eliminated, so that sticky materials are not likely to build up and choke the machine. The centrifugal fan used is of greater efficiency and can be adjusted quickly without the use of tools for any fineness between 60 and 325 mesh. The company claims that there is practically no limit to the fineness which may be obtained and that the machine will reseparate the finest air- or water-floated material made by any other device or process. The new fan permits many combinations, making possible changes as small as 0.5 per cent at the coarser meshes and 0.1 per cent at the finer settings. Every adjustment is a definite step which can be returned to at any time. The increased efficiency of the fan is effected through the improved design of the blade.

If it be desired to use this separator for abrasive materials, the separating chamber may be fitted with replaceable liners. Other improvements in the machine include a new oiling system eliminating waste of oil. Moreover, no oil or grease cups are used, and it is impossible for oil to get into the product or for the bearings to run dry. Finally, because of the basic principle involved, the machine may be run at varying speeds without affecting the fineness of the product.

Drill Steel Heat-Treating Machine Improved

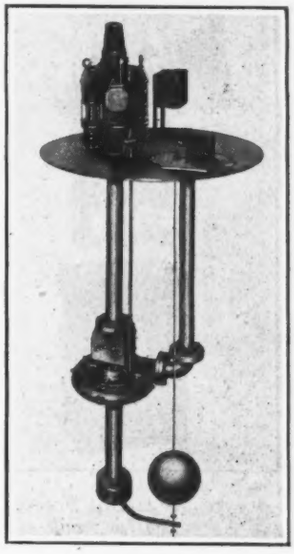
The automatic heat-treating machine for hardening and tempering rock drill bits automatically, by mechanical and electrical means, has already been described in these pages and elsewhere. In the model described, however, the furnace used was of the oil-burning type. The Gilman Manufacturing Company, East Boston, Mass., which makes the machine, has recently introduced an improved model in which an electric furnace is employed. The new furnace is of the Globar type, consisting of a heating chamber, rectangular in section with a slot extending lengthwise in its top cover, through which the drill steels, suspended on carriers from the circular track of the machine, are inserted. When in the heating chamber the bit is heated by radiant heat from the Globars to the exact hardening temperature desired. It is then automatically removed from the furnace, hardened by quenching in a fountain of cold water, and tempered, after which it is automatically ejected, ready for use. The company claims that the automatic control mechanism insures that the temperature of the drill bit is held within 5 deg., plus or minus, from its exact critical range temperature at the instant the drill steel is removed for quenching. The machine consumes 32 kw. when heat-treating bits at the rate of 100 per hour.

One Motor Operates Furnace Door Hoist

An electric hoist for operating the doors of open hearths and other furnaces has been developed by the Blaw-Knox Company, Pittsburgh. The hoisting mechanism is situated back of the furnace and operated by a single motor. This motor operates a main shaft, which in turn operates pulley sheaves on which cables leading to the various doors of the furnace are wound with a single turn. These cables cross the furnace at the top, each carrying a door at one end and a counterweight at the other. In this way the cables are kept taut, which in turn keeps the doors in a vertical position and close to the furnace. Each sheave is actuated through a clutch and is stopped by a brake. Clutch and brake are operated by a solenoid. Individual control of each door, effected by a push button, is provided.

New Pumping Equipment

Three new devices for pumping service have been introduced. One is a differential water-pressure regulating valve, known as the Copes Type SS valve, designed to regulate excess water pressure across the control valve of a feed-water regulator in a boiler-feed line. It can be used with any feed-water regulator to maintain the desired pressure drop, regardless of variations in boiler drum pressure or in the pump



An improved sump pump

pressure, or regardless of the friction loss in the feed line to the boiler. In the new valve, the actuating element is a four-ply brass sylphon bellows, which is influenced by the differential water pressure. The new valve may be had in all sizes and may be placed in either horizontal or vertical feed lines.

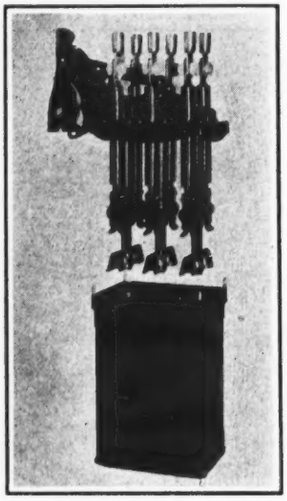
The second of the devices referred to is the new governor developed by the same company for installing on simplex, duplex, or triplex pumps and on turbine- or motor-driven centrifugal pumps. This governor is suited for differential excess pressure service for boiler feeding; for constant-pressure service; for differential reducing-valve service on motor-driven centrifugal pumps, and for relief valve service on belt- or gear-driven pumps. The actuating element, as in the case of the valve previously referred to, is a two-ply brass sylphon bellows, which can be subjected to practically an unlimited number of reversals without failure and is said to be unaffected by high steam or water tem-

peratures, as well as to be able to withstand an unbalanced pressure of more than 400 lb.

The accompanying photograph shows the third device, namely an improved sump pump, introduced by the American Well Works. This pump employs a hollow-shaft motor in place of the old solid-shaft type. Compact construction is thus made possible. The pump shaft extends up through the motor shaft so that motor and pump can use the same thrust bearing. High motor supports are eliminated. The pump-shaft bearing consists of removable bushings. The pump may be had for all standard settings up to 17 ft. head in either single or duplex units.

This Circuit Breaker for Small Plants

In the accompanying photograph is shown the new oil circuit breaker announced by General Electric Company for manual or electric operation. It is



A new oil circuit breaker intended for small installations

known as the Type FK-33 and is rated at 4,500 volts, 200 and 400 amp. 2-, 3-, and 4-pole, single and double throw, and has an interrupting capacity of approximately 20,000 kva. at rated voltage. The company recommends it for use in small installations and wherever a breaker of moderate interrupting capacity is required.

An Unbreakable Trolley Wheel

A new turret-type mine harp and pole-head casting for wheel and glider operation has been introduced by the Ohio Brass Company, Mansfield, Ohio. The term "turret type" is used because of the turret-shaped bearing between the pole-head casting and the swivel harp casting. A projecting turret on the pole head casting, $1\frac{1}{2}$ in. in diameter and $1\frac{3}{8}$ in. high, fits into a corresponding socket on the harp casting, making a smooth machined bearing of large area. Both castings are of malleable iron, and it is claimed that this, combined with the design, makes the device almost unbreakable in case the wheel leaves the trolley wire and strikes the roof or timbers.

Although the harp for glider operation also utilizes the turret principle, it differs in design from the harp for the wheel. Connection between glider and harp is made by large ball-and-socket joints. Between these, heavy copper bearing-washers, formed to the contour of the ball, are fitted. Wear at these joints falls on the washers, this materially increasing the life of the harp. The glider is so pivoted at the center of contact as to overcome any tendency to rotate forward or backward. Where service is heavy and high currents are used, a copper shunt attached to the glider is employed to carry the current from the glider around the harp to the terminal on the pole-head casting. This adds to the life of the bearing surfaces.

Air-Filter Medium Improved

A modified type of air-filter medium that will handle air at higher velocity without increasing resistance has been developed by Midwest Air Filters, Inc., Bradford, Pa. This is made possible by the use of air guides of sinuous shape, in the medium. The manufacturer claims that the new design increases the capacity of the filter without decreasing its efficiency.

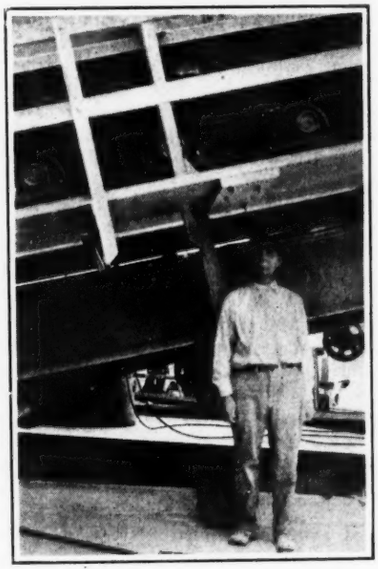
Ajo Mill Has Largest Pan Feeder

A DESCRIPTION of the pan feeder installed at the Ajo concentrator of the New Cornelia Copper Company should be of interest if for no other reason than it is, as far as known, the largest of its kind in use. At shovel or pit mines the benefits arising from constant feed of pit rock to the primary breaker are recognized. However, satisfactory feeder designs have not been always available. Consequently the practice has been to dump pit cars, regardless of tonnage, into the crusher, possibly burying the hopper, or else to control the rate of dumping. The usual result is a loss of time in handling trains, especially where the rate of dumping is slowed up.

When the New Cornelia sulphide mill was built, a 500-ton bin was provided for receiving pit rock and a feeder was installed for removing it from the bin and delivering it to the primary breaker. The arrangements also included direct dumping into the breaker. Nearly a year ago the original feeder was replaced by one manufactured by the American Manganese Steel Company and designed by Corey C. Brayton, an engineer of the same company. The general design is the same as that used in other installations made by this company.

Of the orginal installation, the main framework and the drive were used. The feeder is 72 ft. in length and 8 ft. in width and is set on an incline of about 18 deg. All working parts except shafting and bearings are of manganese steel. The flights are $\frac{3}{4}$ in. in thickness and form a smooth floor without corrugations. The overlap, both in floor and at sides, is sufficient to prevent leakage or spill when the flights pass around the drive sprockets. Flights are riveted to two chains made up of links with renewable bushings in the back-eye and T-head pins. The pin, when worn, may be reversed and the chain pitch one-half restored. Renewal of both pin and bushing restores chain pitch completely. The chain is designed with a one-way or knee joint that prevents sag between supporting track wheels. The sprockets are nine-tooth and the tail idlers are round with the same pitch diameter as the sprockets. Those track wheels that support the load and the return side are flanged and pressed on their shafts.

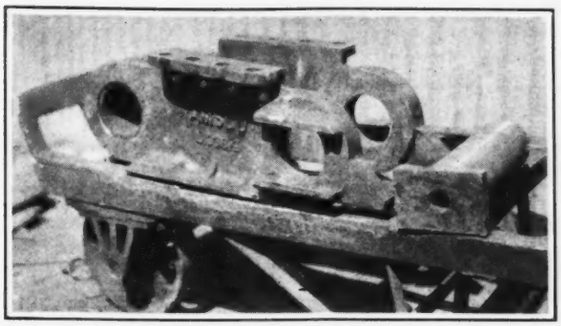
The feeder runs intermittently on two 8-hour shifts per day, handling 900 tons per hour and about 8,000 tons per day. Speed is 10 ft. per minute. The dumping practice is as follows: A train of six 40-ton cars is dumped in a few minutes into the storage bin. The feeder is started and operated until the bin is empty, when it is shut down. Likewise, the crusher may be shut down, but this depends upon the proximity of the next train. The indicating wattmeter shows a uniform power input of 30 kw. Power consumption based upon several months' tonnage and the recording wattmeter is 0.03 kw.-hr. per ton of ore handled. Pit shovels are equipped with 4 cu.yd. dippers, and as the ore breaks large there is a considerable percentage of pieces of rock about 4 ft. in length and



Side view of pan feeder at sulphide mill of New Cornelia Copper Company, Ajo, Ariz.

an appreciable percentage of long pieces up to about 6 ft. in length.

The throat or outlet of the bin is liberal in size, and therefore only an occasional jam occurs, in which event it may be necessary to use a small quantity of explosive to release it. To provide against possible damage to flights and other parts from such shoot-



Link and pin with inserted bushing. Note size of link compared with wheelbarrow

ing, three rails are installed under and just clearing the flights beneath the bin and for a short distance forward.

One interesting feature is the total absence of leakage through the top run or loaded side. The spill due to drag back of moist fines sticking to the flights is a small item. Maintenance as a result of leakage and spill is practically nil. The chains require no lubrication, and there is therefore a saving in operating labor and in lubricants. It is of interest to note that the tail end of the feeder has been set back 4.5 in. during the total period (about eleven months) of operation to date.

At the end of the period of operation mentioned above the take-up of the tail end of the feeder totaled 4½ in. The initial take-up after about a month's operation was four inches, due to seating of parts, so that ½ in. represents the wear in all of the pins and bushings during about ten months' operation. Thus the length of the apron in which there are 100 flights increased as a result of wear about one inch, or about 1/100 in. per joint. This is distributed in an equal amount between pins and bushings.

INDUSTRIAL NOTES

K. P. Swensen has been placed in charge of the New York office of The Radiore Company, 117 Liberty St.

Wise & Braisted, General Motors Building, Detroit, have been appointed district sales agent in Michigan for the Roller-Smith Company, New York.

The corporate name of "Canadian Giant Limited" has been changed to "Canadian Explosives Limited." The company's head office is at Vancouver, B.C.

Albert N. Dingee has been appointed advertising manager for the Electric Storage Battery Company, Philadelphia. He succeeds the late Alfred B. Kreitzburg.

Spencer S. Swasey, Chicago, has joined the Walter A. Zelnicker Supply Company, St. Louis, as manager of the equipment department. Mr. Swasey was formerly with the George D. Whitcomb Company.

Walter G. Hildorf has been placed in charge of all metallurgical work of the Timken Steel & Tube Company, Canton, Ohio. For several years he has been metallurgical engineer for the Reo Motor Car Company.

Harold C. Osman, secretary of the Nugent Steel Castings Company, Chicago, has been made works manager. R. D. Kelly has been placed in charge of the aeronautical instruments department, and G. K. Calhoun has been appointed technical director.

BULLETINS

LOCOMOTIVES — Mid-West Locomotive Works, Hamilton, Ohio. A 24-page bulletin on gear-drive gasoline locomotives.

LUBRICATION VALVES—Merco Nordstrom Valve Company, 343 Sansome St., San Francisco. Catalog No. 6. Nordstrom valves. Pages 142.

ARC WELDING—The Lincoln Electric Company, Cleveland, Ohio. A 32-page pamphlet entitled "How to Begin the Application of Arc Welding in Production Manufacturing." Price 50c.

BLOWERS — The Connersville Blower Company, Connersville, Ind. Bulletin 25. The "R-S" series of rotary positive blowers, of capacities of 400 to 15,000 cu.ft. per minute. Six pages.

LOCOMOTIVES—Atlas Car & Manufacturing Company, Cleveland, Ohio. Bulletin No. 1223. Type J spur-gear drive storage-battery locomotive for tramming service. Eight pages.

RECORDING INSTRUMENTS—The Bristol Company, Waterbury, Conn. Catalog No. 1,900, featuring the company's long distance electric transmitting and recording system. Twenty-four pages.

LOCOMOTIVES—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Reprint 336 entitled "Large Main Haulage Mine Locomotives"; also reprint 337 entitled "Importance of Equalization in Locomotive Design." Eight pages each.

SCRAPER HOISTS — Sullivan Machinery Company, 122 South Michigan Ave., Chicago. Bulletin 76-J. Portable electric hoists of the double-drum type for scraper loading; also single-drum type for general utility (10 to 35 hp.). Thirty-one pages.

MEASURING ELECTRICAL RESISTANCE—Leeds & Northrup Company, Philadelphia. Bulletin No. 434 (revised). "Students' Kelvin Bridge." The Kelvin Bridge is similar to the Wheatstone Bridge in that the unknown resistance is compared with a standard resistance. The significant difference is that the effect of lead and contact resistance is overcome in the former.

WATER-COOLING EQUIPMENT — Revision of the A.S.M.E. Power Test Codes. The text intended for use at the public hearing to be held in New York Dec. 4, 1928. Those interested have been invited to submit criticism in person at the meeting or to write to C. B. LePage, secretary to the A.S.M.E. Main Committee on Power Test Codes, 29 West 39th St., New York.

PATENTS

FURNACE RABBLE ARM. No. 1,687,935. Oct. 16, 1928. Edward J. Fowler, assignor to Nichols Copper Company, New York.

MINING APPARATUS. Reissue No. 17,109. Oct. 23, 1928. Frederick B. Miller, Scottdale, Pa.

ROCK DRILL MECHANISM. No. 1,688,807. Oct. 23, 1928. Elmer G. Gartin, assignor to Sullivan Machinery Company.

SINTERING EARTHY MINERALS. No. 1,688,422. Oct. 23, 1928. Reed W. Hyde, assignor to Dwight & Lloyd Metallurgical Company, New York.

ROCK DRILL. No. 1,687,687. Oct. 16, 1928. Ernest Penberthy, assignor to Climax Rock Drill & Engineering Works, Ltd., London, England.

RECOVERING POTASH. No. 1,688,873. Oct. 23, 1928. Norman M. McGrane, assignor to International Precipitation Company, Los Angeles, Calif.

ROCK DRILL VALVE. No. 1,688,633. Oct. 23, 1928. George W. Hulshizer, assignor to Ingersoll-Rand Company, New York.

ELECTRIC FURNACE OPERATION. Nos. 1,687,936 and 937. Oct. 16, 1928. A. E. Greene, Medina, Wash.

These two patents cover the method of making and finishing a heat of steel in an electric arc furnace; also the electrode crane used.

FURNACE. No. 1,687,925. Oct. 16, 1928. A. J. Briggs, assignor to Onondaga Steel Company, Inc., New York.

A metallurgical furnace having a rotatably mounted cylindrical working chamber with an end opening provided with a door which in turn has an opening through which the heating means may be advanced into the chamber.

SMELTING APPARATUS. No. 1,686,912. Oct. 9, 1928. Charles E. Glessner, Portland, Ore.

A smelter having a centrifugal extractor with a vertical axis and annular grooves; also a metal collector at the lower end of the extractor forming a seal for it; also a means for circulating air downward through the extractor and for feeding crushed ore uniformly into its top.

FLOTATION. No. 1,688,277. Oct. 16, 1928. Kojiro Kawamura, assignor to Yoshimatsu Yokohama, Kanazawa, Japan.

This covers the process of differentially floating ores comprising the addition of crude commercial anhydrous chromic acid with alkali to neutralize sulphuric acid therein to a pulp containing a mixture of sulphide minerals. The chromic acid is added in quantity sufficient to inhibit flotation of the cupriferous and ferric sulphides without affecting zinc sulphide.

REFINING LEAD BULLION. Nos. 1,686,187 and 188. Oct. 9, 1928. George Kenneth Williams, Port Pirie, South Australia.

The first of these patents covers an apparatus comprising a vessel within which a deep narrow column of molten material may be maintained and having means whereby different temperatures may be applied at different portions of it; also a means for withdrawing independently products from it at or near the top and the bottom. The second of the patents covers a process for refining bullion containing alloying metals by incorporating zinc with the bullion and subjecting it to such differential temperatures that molten layers of conjugate solutions are formed on the upper layer comprising an alloy rich in certain alloying metals, and separating such alloy in a liquid system.

Recent Technical Publications

Ambronn Translated

ELEMENTS OF GEOPHYSICS *as Applied to Explorations for Minerals, Oil and Gas. By Dr. Richard Ambronn, Göttingen, Germany. Translated by Dr. Margaret C. Cobb. McGraw-Hill Book Company, 370 Seventh Ave., New York. Pages 372. Price $5.*

THE widespread interest taken by the mining profession in geophysics as applied to the discovery of ore deposits makes any text in English sure of a welcome. Especially is it true of this translation of Dr. Ambronn's book, already so well known in its original German. The translator, Dr. Cobb, is to be congratulated on having ably performed a difficult task.

This work is not to be regarded as a textbook. Such a venture, Ambronn says, would extend far beyond the permissible compass of the book. Rather he seeks to make the geologist and the engineer thoroughly conversant with the general bases of applied geophysics, so that they may collaborate the better with the practical geophysicist. He hopes also to enable those interested in mining and engineering to eliminate the chaff from the many doubtful undertakings that spring up with the success of scientific work. Geophysical work, moreover, entails expense, he says, and it will be profitable to select the right methods of investigation at the outset. His effort to make his language simple and understandable has been seconded by the translator.

Some idea of the specific contents of the book will be afforded the reader by the topics of the eight component chapters. These are:

"The Development and Present Position of Geophysical Methods Applied to Prospecting."

"The Influence of the Subsurface Formations of the Gravitational Field at the Surface of the Earth."

"Magnetic Methods of Investigation."

"The Use of Radioactive and Atmospheric-electric Measurements for Geophysical Prospecting."

"Energy Currents."

"Electrical Methods of Prospecting."

"The Investigation of the Structure of the Subsoil by Means of Elastic (Seismic) Waves."

"The Distribution of Temperature in the Earth's Interior and the Use of Temperature Measurements in Applied Geophysics."

A bibliography of no less than 1,672 items should be regarded as a feature—an essentially German feature—of the book. Thoroughness, thy name is German!

Presentation of fundamentals is the primary object of the book, even though the author does not wish it to be regarded as a textbook. Moreover, it will serve as a guide to the literature, in all languages, on applied geophysics, and so will be doubly useful to the technical man who has a command of foreign tongues.

A. H. HUBBELL.

DE RE METALLICA. *By Georg Agricola. Translated from the original Latin into modern German by Carl Schiffner, assisted by Ernst Darmstadter, Paul Knauth, Wilhelm Pieper, Friedrich Schumacher, Victor Tafel, Emil Triptow, Erich Wandhoff. Five hundred and sixty-four pages, 8½ x 13 in. Illustrated with reproductions of the original woodcuts. Published by the Agricola Gesellschaft beim Deutschen Museum and sold through the VDI Verlag G.m.b.h., Berlin. Price: In full parchment, 75 renten marks; in half parchment, 45 renten marks.*

IN THE introduction to the English translation of this monumental sixteenth century work, made by Herbert Clark Hoover and Lou Henry Hoover during a period of five years, and published by *The Mining Magazine* in London in 1912, surprise is expressed that there has never been a respectable translation of Agricola's masterpiece from the Latin in which he chose to write into his native German. The present volume is apparently an answer to that challenge, and seems to be exceedingly well done, according to an anonymous reviewer in *American Machinist*.

For those who never heard of Georg Agricola, or Bauer, as he was born, it will be sufficient to say that he was a German philosopher, savant, and public man, who was born in 1494 and died 62 years later. He is believed to have spent some 25 years in the preparation of this book, which was published by Froben, in Basal, after his death.

According to the Hoover foreword, Agricola's book is the first treatise on mining and metallurgy ever written and was the only one for some 200 years later. Much of the practice is not original with him, but represents the accumulated skill of the miners among whom he lived in the mountainous mining district of Saxony.

The work is in twelve books or divisions, each dealing with a separate phase of mining or metallurgy. In the words of Agricola, "Of these, the first book contains the arguments which may be used against this art, and against metals and the mines and what can be said in their favor. The second book describes the miner, and branches into a discourse on the finding of veins. The third book deals with veins and stringers, and seams in the rocks. The fourth book explains the method of delimiting veins, and also describes the functions of the mining officials. The fifth book describes the digging of ore and the surveyor's art. The sixth book describes the miner's tools and machines. The seventh book is on the assaying of ore. The eighth book lays down the rules for the work of roasting, crushing and washing the ore. The ninth book explains the methods of smelting ores. The tenth book instructs those who are studious of the metallic arts in the work of separating silver from gold, and lead from gold and silver. The eleventh book shows the way of separating silver from copper. The twelfth book gives us rules for manufacturing salt, soda, alum, vitriol, sulphur, bitumen and glass."

CORROSION—Several publications on the subject of corrosion have recently appeared. The American Zinc Institute has issued an 82-page pamphlet entitled "Zinc and Its Corrosion Resistance," which it prices at $1 postpaid in the United States and $1.15 in Canada. Copies of three papers to be presented at the meeting of the American Petroleum Institute in Chicago on Dec. 3-6 have also been received. They are: "Accelerated Protective Coating Tests," by C. T. Langford, Marland Companies; "The Use and Behavior of Protective Coatings on Underground Pipes," by Gordon N. Scott, research associate of the Institute at the Bureau of Standards; and the Progress Report of the Refinery and Marine Subcommittee of the A.P.I. Committee on Corrosion for 1928, presented by H. F. Perkins, of the Gulf Refining Company.

STRESSES IN HOISTING ROPES—G. P. Boomsliter, professor of mechanics at West Virginia University, is the author of a paper entitled "Acceleration Stresses in Hoisting Ropes," which is published as Research Bulletin No. 2 by the Engineering Experiment Station at the University. Professor Boomsliter's conclusion's are as follows:

1. Theoretical calculations show that acceleration stresses in hoisting ropes are, due to their elasticity, much greater than are ordinarily assumed, and laboratory experiments check this closely.

2. A field test of a mine hoisting rope indicates that these stresses are somewhat modified by the fact that the acceleration is not constant, but starts at a low value and increases. This test however gives maximum values of stress reasonably close to those calculated.

3. Acceleration stresses will be considerably reduced by "straining" the rope before beginning the hoist proper.

4. Sudden shocks or jerks and the throwing out of an automatic circuit breaker throw excessive stresses into the rope.

5. The design of rope with due regard to acceleration stresses using a factor of safety of 4 or 5 should materially lengthen the life of a rope.

6. The modulus of elasticity of a rope after considerable use is probably nearer 20,000,000 lb. per square inch than 12,000,000 lb. per square inch.

Personal Notes

J. C. BRUMBLAY, of Mason Valley Mines, is in New York.

S. O. OSLAND, of Billings, Mont., has bonded the Wagner mine, near Juneau, Alaska.

MICHAEL J. CALLOW, of General Engineering Company, Salt Lake City, is in New York City.

ROSS B. HOFFMAN, mining engineer, of Oakland, Calif., has recently returned from London.

SYDNEY H. BALL, of Rogers, Mayer & Ball, mining engineers, is in Canada on a professional trip.

C. B. LAKENAN, former general manager of Nevada Consolidated, has returned to New York City.

C. N. SCHUETTE, mining engineer, of San Francisco, recently visited quicksilver properties in Nevada.

H. D. KEISER, assistant editor of *Engineering and Mining Journal*, has left Utah for New York City.

W. R. WADE, mining engineer for the John Hays Hammond interests in New York, is in Arizona for three weeks.

J. H. EBY, mining engineer, of Spokane, is in charge of operations at North Bunker Hill, a Coeur d'Alene property.

ROWLAND KING, mining engineer, of Seattle, recently examined a group of silver-copper properties near Snake River, Idaho.

FERNANDO BENITEZ has been appointed metallurgist to the Caja de Crédito Minero, of Chile, with headquarters in Santiago.

HEBER C. HICKS, secretary of the Utah State Security Commission and interested in Utah mining affairs, is visiting New York City.

W. V. SMITHERINGALE has joined the engineering staff of R. H. Stewart, H. L. Batten and Associates, Vancouver, B. C.

DUNCAN MACVICHIE has returned to Salt Lake City after a trip to the Portland Canal district of British Columbia and Tacoma, Wash.

GEORGE H. GARREY, consulting geologist, who has been engaged in mine examination work since last March, has returned to his Philadelphia office.

GUY E. INGERSOLL has been appointed assistant professor of mining and metallurgy at the State College of Washington. He is in New York on business.

IRVING J. LOUIS, first vice-president of the National Metal Exchange, has organized the firm of I. J. Louis & Company, Ltd., specializing in tin and rubber.

JOHN REAGAN, manager and chief owner of Morning Star Mines, has returned to Los Angeles after a trip of inspection to the property at White Pine, Colo.

IVAN LUHR has been elected president of a new Pend Oreille company, known as Scandinavian Pend Oreille Mining, which owns properties close to the Canadian boundary.

G. W. LAMBOURNE, president and general manager of Park Utah Consolidated, has returned to Salt Lake City after a business trip of several weeks to New York and other Eastern cities.

E. W. ELLIS, assistant professor of mining and metallurgy and for the last five months acting dean of the University of Idaho School of Mines, has resigned his position to become metallurgical expert for Anaconda Copper in connection with the Carson patent suit.

ERNEST W. ELLIS

Professor Ellis will conduct experiments with two smelting furnaces, one utilizing Anaconda's regular smelting methods and the other embodying features of the Carson patent, to obtain data as to the extent of the infringement. This data will be used as a basis for settlement in the suit, which Anaconda recently lost. Professor Ellis received both his degrees in mining from the Idaho School of Mines. Since 1913 he has been a member of the faculty of the school in various capacities.

L. O. KELLOGG has returned from Ecuador, having resigned his position of superintendent with the South American Development Company, and expects to reside, for a time at least, in Carmel, Calif.

T. A. RICKARD and MRS. RICKARD will leave San Francisco on Dec. 23 for Europe. They will go by way of New Orleans and Havana to Santander, Spain, from which city Mr. Rickard will go to Cyprus.

H. W. TURNER was recently in Butte arranging for the reopening of the old Jib mine at Basin, Mont. WILLIAM C. MADGE will be the local manager of operations for the new company, known as Basin Cataract Mining.

PERCY E. HOPKINS, mining geologist, has been appointed to make a thorough investigation of its property by the Jackson-Manion company in view of the persistent rumors of unsatisfactory conditions. The mine is in the Red Lake district, northern Ontario.

JAMES L. STONE, president of the Spokane Chamber of Commerce, spoke on the importance of mining in the Pacific Northwest before a recent meeting of the mining bureau of the Spokane Chamber of Commerce and the Northwest Mining Association.

D. D. MUIR, vice-president and general manager of U. S. Smelting Refining & Mining, recently completed an inspection trip to the properties of the company at Fierro, N. M. Shipments are being made to Colorado Fuel & Iron at the rate of 1,000 tons of iron ore daily.

Dr. CHARLES P. BERKLEY, head of the geology department of Columbia University and a member of the engineering board appointed to report on the Colorado River to the U. S. Department of the Interior, spoke on "Geologic Evidence of Change in Climate," at Denver, on Nov. 24. The lecture was given under the auspices of the Colorado Scientific Society.

C. C. Ross, supervising engineer of the Canadian Department of the Interior, who has been investigating conditions in northern Manitoba and Saskatchewan mines, has been sent to confer with the ministers of mines of those provinces on the possibility of making such changes in local mining regulations as have become necessary as a result of recent expansion in mining operations.

EDWIN J. COLLINS, of Calumet, Mich., has been appointed a member of the board of control of the Michigan College of Mining and Technology at Houghton by Governor Green. Mr. Collins, who succeeds Elton W. Walker, resigned, is an alumnus of the college. He is a vice-president of Calumet & Arizona Mining. CURRY S. PRESCOTT, of Menominee, Mich., will succeed his father, the late Fred Prescott, on the board.

OBITUARY

WILLIAM GAUSS, who had been engaged in mining since 1898, died at Colorado Springs, Colo., on Nov. 14.

GEORGE WILDER, 67 years old, of Denver, Colo., died in Denver, on Nov. 19. He formerly owned several mines in Gilpin County, and had been engaged in mining during most of his life.

THOMAS FORTUNE RYAN, financier, died in New York on Nov. 23 at the age of 77. He had been interested in several mining enterprises, notably Belgian and Portuguese companies engaged in development of Angola and Belgian Congo.

NEWS OF THE WEEK

Summary

DISCREPANCY between the ore estimates of the managing director of Jackson-Manion and the engineers of the underwriting syndicate may lead to a thorough government investigation of the situation. Page 879.

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Steam power for Anaconda's Butte mines will be furnished by only two plants in the future, one at the Leonard mine on the east side of Butte hill and the other near the High Ore mine. Page 880.

* * *

National Gold Corporation is developing a group of properties carrying gold, silver, arsenic, and lead, near Miller River, Wash. All operations are to be carried on through one tunnel in the future. Page 881.

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Closer co-operation between the three principal operating companies in the Broken Hill district of Australia was urged by the chairman of Broken Hill South at its most recent meeting. Page 883.

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At Morenci, the Phelps Dodge Corporation has driven the new drainage tunnel, which will provide an outlet for water from the Humboldt mine, more than half the total distance required. Page 881.

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Flotation materials imported into Mexico will enter duty free hereafter. Large savings for the complex-ore producers should result. Page 883.

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Four crosscuts on the 300 level struck ore at N'Changa Copper Mines, according to reports received at the London office of the company. Page 879.

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Diamond drilling has been started in the Cliff and Phoenix mines, controlled by Calumet & Hecla Consolidated. Page 882.

International Commission Reviews Testimony in Smelter Fume Case

By Paul Wooton
Special Washington Correspondent

MEMBERS of the International Joint Commission are reviewing the testimony recently taken in the investigation of alleged damage in the State of Washington caused by fumes from the smelter of Consolidated Mining & Smelting at Trail, B. C. As soon as they have thoroughly examined testimony and exhibits before them, they will have a formal meeting to map out a plan for pursuit of the investigation.

Statements before the commission as to the extent of the damage caused by the fumes vary widely. Representatives of the smelting company contend that damage to crops did not exceed $3,000 in 1926 and 1927, and that actual losses in 1928 did not exceed $600. On the other hand, representatives of the farmers and of the Washington country contiguous to the British Columbia area, in which the smelter is situated, contend that $600,000 or $700,000 is a more correct indication of the "economic importance of the question involved."

The problem presented to the International Joint Commission is a particularly difficult one, since the laws of Washington are such as to preclude any purchase of lands or easements by nationals of other countries. It also is recognized that a decision in this case will constitute a precedent of far-reaching effects. Whatever is done will have an important bearing on the future erection of smelters in this mineralized area. The attention of the commission has been directed to the fact that even now consideration is being given to the erection of a smelter on the American side of the boundary in the Pend Oreille district.

That Consolidated has spared no effort or expense to prevent smoke damage is brought out clearly in testimony of S. G. Blaylock, its vice-president and general manager. He pointed out that such damage as has been caused is due to sulphur dioxide and not to lead dust, and explained that it is impossible to do a great deal with sulphur dioxide unless there is a market for the products into which it can be transformed. To dispose of a large amount of sulphuric acid daily would be impossible under present conditions. Constant research is being carried on in the hope of finding some way that the sulphur itself could be isolated and stacked up. Large expenditures are being made to interest farmers in the prairie provinces of Canada in the use of fertilizers, which then would provide some outlet for sulphuric acid needed in production of superphosphate. Mr. Blaylock called attention to the fact that the Supreme Court of the United States in the Anaconda case took the position that the smelter was of more value to the district than were farming operations and refused to limit its operations. He pointed out that the Trail smelter was the first to adopt the improved Cottrell method of controlling solids in the gases. Some years afterward it was found that better clearance could be obtained by the use of steam sprays. With seven Cottrell installations and operation and the steam system, a clearance of 97½ per cent is being obtained. For that reason he pointed out that no just claim could be made of trouble from dust.

In settling with farmers on the Canadian side of the border the company bought large tracts of land. Mr. Blaylock called attention to the fact that these lands now are being operated with great success by the company.

W. Lon Johnson, a former Governor of Washington, and the attorney representing Consolidated, attributed the attitude of a portion of the people in Stevens County to radicalism and unfair propaganda. He explained that the company is anxious to settle actual damage on a most generous basis. "Everything that happens to a crop in this vicinity," Governor Johnson said, "immediately is attributed to smoke. Timber far removed from the smelter has the identical appearance of much of the timber in this section." Governor Johnson urged that the commission consider the question under Article 10 of the treaty. In this way the commission itself could reach a final determination of the questions involved. The objection to this method, however, is that it must receive prior approval from the national legislative bodies of the two countries. The investigation is being conducted under Article 9 of the treaty, under which it may make recommendations only. If it is considered impracticable to attempt to deal with the matter under Article 10, Governor Johnson then urged the commission to recommend that the smelting company be given the right to purchase smoke easements within the United States.

Ontario Government May Investigate Situation at Jackson-Manion

Wide Discrepancy Between Ore Estimates by Managing Director of the Property in Red Lake District and Engineers of Underwriting Syndicate Causes Demand for Official Inquiry

THE situation with regard to the Jackson-Manion, in the Red Lake district in northern Ontario, may possibly result in a government investigation. It arises from the wide discrepancy between ore assays as given out by the managing director of the company and as determined by engineers appointed by the underwriting syndicate. In an official report covering the period to the end of September, the managing director stated that, on the 250 level, representative assays, a list of which were given, indicated approximately $20 for a width of 7 ft. The same report stated that a conservative estimate of the average ore drifted through to date would be over $12 a ton. In a supplementary statement to Oct. 30, ore reserves to the 200 level were estimated at $1,600,000. The underwriting syndicate, not being satisfied with these statements, had a report made by independent engineers, and the findings of the report have been made public. This shows that on the 125 level the vein averages $11.35 for a width of 5 ft. and a length of 185 ft. On the 250 level results for the vein south of the crosscut were considered too poor to average. The central portion was not sampled, as it is in barren material. The best section was north of the crosscut and showed $2.52 a ton 4.5 ft. wide and 75 ft. long. A diamond-drill hole cutting the vein 125 ft. below the 250 level had a low gold content. It now develops that the mine sampling of the 250 level showed that south of the crosscut the average was $4.13 for a width of 5.7 ft. and a length of 85 ft. The central portion averaged 98c., 5.8 ft. wide and 95 ft. long; and the section north of the crosscut averaged $2.87, 5.8 ft. wide and 90 ft. long. On the strength of the official statements the stock sold close to $1, as compared with its present price of 17 to 20c.

On Nov. 23, the Attorney General's department of Ontario sent out a questionnaire to all Toronto brokers, with orders to report on all transactions in Jackson-Manion shares executed by the brokers between Oct. 1 and Nov. 20. Information is requested as to the number of transactions in Jackson-Manion on each day of the period named; the total shares bought or sold by the broker on each day; the name of each client for whom the stock was bought or sold; and the number of such shares, the price, and the name of the broker from whom bought. These instructions are signed by the solicitor for the department, who represents the Attorney General under the Securities Frauds Prevention Act.

Copper Discussed at A.I.M.E. Local Section Meeting

W. G. SCHNEIDER, of the Copper and Brass Research Association, addressed New York section, A.I.M.E., at its November meeting on the subject of the economics of the copper industry. Following the customary informal dinner, a standing tribute was paid the memory of Sidney J. Jennings, whose sudden death on Nov. 17 deprived the mining and metallurgical fraternity of one of its most prominent members. Chairman Sidney Rolle then presented Mr. Schneider, who read a paper which he had prepared, "The Copper Industry; Its Progress Since the War."

Charts and graphs showing general trends in production, stocks and shipments of various producing units as compared with other units and world rates were shown to supplement the exposition of the text. Though dealing largely in generalizations and trend analyses, Mr. Schneider placed an estimate on 1928 world production at 1,840,000 tons and on 1928 domestic consumption at 1,000,000 tons. He pointed out that the rôle of the Copper and Brass Research Association, in promoting the use of copper for building purposes, in brass pipe for plumbing purposes and in various other fields, had been of great importance. Among other relatively new outlets for increasing tonnages of copper the manufacture of radios, electric refrigerators, burglar-proof bank vaults, and the electrification of railways are noteworthy.

In the discussion following Mr. Schneider's paper, many of the members present exhibited a keen interest in specific figures and relative outputs at individual properties. Mr. Schneider's statement that the copper industry was and had been operating at 100 per cent of capacity was not in complete accord with the opinions of some of the members. H. DeWitt Smith supplemented the previous statistical references by pointing out that though the 1928 world productive rate as estimated at 1,840,000 tons was 10 per cent greater than in 1927, the actual rate of world production in October, 1928—173,623 tons—was equivalent to approximately 2,100,000 tons per year or 25 per cent in excess of the 1927 rate. H. Foster Bain contributed to the discussion and stressed the importance of the large per capita consumption of all metals in the United States as compared with the small per capita consumption in European countries as indicative of an immense potential market to be supplied as the standard of living approaches a common level throughout the world. Dr. Bain pointed out, also, the tremendous importance of the radio—a representative copper "product"—in bringing out the large popular vote in the recent Presidential election. Clinton Bernard took up the theme suggested by Dr. Bain—relative per capita consumption of metals—mentioning that most of the electrical appliances used in the average American household are never found in Germany, for instance, except in the homes of the very wealthy. C. H. Schneider, of Copper Exporters, Inc., spoke briefly on the outlook for future increases in copper consumption on the Continent.

American Mining Congress Meets Dec. 5-8

THE AMERICAN MINING CONGRESS, national organization of the mineral industries, will hold its 31st annual convention at the Mayflower Hotel, Washington, D. C., on Dec. 5-8 and plan for the extension of its present activities. The convention is expected to draw to Washington leaders of all branches of mining for consideration of questions closely connected with its continued prosperity. States having important mining interests will send official delegates, and representatives of various government departments having contact with mining will participate.

J. G. Bradley, of Dundon, W. Va., will open the convention as president of the American Mining Congress, with an address on the organization as the "Clearing House for Mining." Senator Tasker L. Oddie, of Nevada, chairman of the Senate Committee of Mines and Mining, will speak on "The Legislative Outlook for Minerals." Other speakers include J. W. Furness, chief of the mineral division of the Bureau of Foreign and Domestic Commerce, who will speak on "The Flow of Minerals in World Trade"; S. L. Mather, president of Cleveland-Cliffs Iron, on the iron industry; C. F. Kelley, president of Anaconda Copper, on "The Future of Copper"; and B. Mifflin Hood, president of the B. Mifflin Hood Brick Company, on "The Future of Non-Metallics."

Four Crosscuts on 300 Level Strike Ore at N'Changa

REPORTS received at company headquarters in London by H. C. Hankins, secretary of N'Changa Copper Mines, Ltd., indicate that four crosscuts on the 300 level of the main shaft at the property in Northern Rhodesia have struck ore containing from 3.37 to 5.31 per cent copper. At a point 125 ft. east of the shaft, No. 1 crosscut exposed 60 ft. of ore averaging 5.31 per cent copper. No. 2 crosscut struck 81 ft. of 5 per cent ore about 250 ft. west of the shaft. In the No. 3 crosscut, 275 ft. west of the shaft, results were 90 ft. of ore, averaging 3.37 per cent, and in the No. 4 crosscut, 500 ft. west of the shaft, 62 ft. of the same grade.

Two Steam Plants to Serve All Anaconda's Butte Mines

TWO modern automatically fired boiler plants, with a total capacity of 6,000 hp., will meet all the requirements of Anaconda Copper's Butte mines in the future. The installation of these two plants is expected to be finished by the end of December. One of the plants will be located at the Leonard mine and the other near the High Ore. The plant at the Leonard mine will generate 2,400 hp. and will serve all the mines on the east side of Butte Hill. The first of the three boilers to be used at the Leonard plant has been in use for about one year, and the other two have recently been started. Although the boilers are rated at only 460-hp. capacity, they have actually operated at double that capacity as a result of more efficient methods of firing. In the Leonard plant, pulverized coal will be used for fuel.

At the High Ore plant, four boilers will be installed. This plant will serve all the mines on the west side of the hill and will supplant six plants which were in service at the beginning of this year. Steam will be delivered to the various mines, some of which are more than a mile away, by means of specially constructed line, varying in size from 2 to 10 in. This is said to be the first installation of a centralized steam-power plant in the West.

Shattuck Options Rights to Winkelman Process

The Ore Reducing Furnace & Concentrating Company is reported to have given an option on the state rights for Arizona and New Mexico on the Winkelman ore-reducing process to L. C. Shattuck, president of Shattuck Denn Mining. The process consists of a method of heat reduction for treatment of low-grade ores. A pilot plant, using the process, will be installed at the Shattuck mine in the Bisbee district. The purchase price mentioned in the option is reported to be $500,000.

Arizona Court Decides in Favor of Carson

On Nov. 19, the federal district court of Arizona decided that Phelps Dodge and Calumet & Arizona Mining had infringed the Carson reverberatory furnace patents, owned by the Carson Investment Company. Announcement was recently made that United Verde Copper had made a settlement with Carson Investment and has taken a license for future use of furnaces using the Carson side-feeding method.

Rush Work on Construction of Wright Creek Mill

Construction of a flotation mill for Wright Creek Mines at its American Flag property, in the Wallapai Mountains, near Kingman, Ariz., is being rushed. The plant will have an initial capacity of 50 tons daily, but the operators plan to increase this next year if development results warrant. The road to the property has been completed and the foundation of the mill should be ready soon. H. C. Block, president of the company, expects to start operations by Jan. 1. Wright Creek ore carries gold, silver, and copper.

Chain O'Mines Completing New Concentrator

The new 150-ton concentrator being erected by Chain O'Mines in the Idaho Springs district, Clear Creek County, Colo., is nearly completed, and company officials expect that production will start soon. The company owns a group of mines near the Argo tunnel on Quartz Hill. The cyanide plant which the company is building will be ready about Feb. 1. J. M. Tippett, formerly superintendent of the Independence mill of Portland Gold, is in charge of the construction work.

New Company Formed in Slocan District

Consolidated Queen Bess Mines has recently been formed, with a capitalization of 2,500,000 shares of $1 par, to acquire the Queen Bess, Idaho, and Alamo groups, totaling 36 claims in the Slocan district of British Columbia. The company is equipped with a 250-ton mill and a 225-hp. hydro-electric plant. The property is reached by the Nakusp and Slocan branch of the Canadian Pacific Railway.

Yellow Pine Option Dropped

The option held by Treadwell Yukon on the Yellow Pine property at Goodsprings, Nev., has been surrendered, as Treadwell Yukon officials do not believe that present conditions are suitable for taking over the property, recently examined by its engineers.

Interocean Tunnel Completed

After more than a year's work, the Interocean tunnel of United Mines Company, at Sunshine, Boulder County, Colo., has been completed. It connects the Interocean, White Crow, Osceola, Monongahela and American mines and is 2,500 ft. long. M. S. Brandt, general manager of the company, expects to be producing regularly next year. The ore carries gold, silver and vanadium.

Dickens Hits New Vein

In sinking from the No. 5 to the No. 6 level at the Dickens Consolidated mine, Cœur d'Alene district, Idaho, a vein was struck about 60 ft. below the No. 5 level and continued to the No. 6. Most of the development work being done in the property is on the No. 6 level. The tunnel is being driven eastward in the expectation of encountering extensions of the ore mined above. The new mill, which was started in October, continues to operate satisfactorily.

New Dredge Launched at Kampar, in Malaya

KAMPAR Malaya Tin Dredging, Ltd., operating at Kampar, with headquarters at Ipoh, Federated Malay States, celebrated the launching of the steel hull of its new dredge, at Kampar, recently, with a formal ceremony. The hull was built by Yuba Manufacturing Company at Marysville, Calif., and designed by Yuba Associated Engineers, Inc. It is 180 ft. long and can dig to a depth of 75 ft. below the water line. The steel buckets each have a 10-cu.ft. capacity.

This is the first of a fleet of dredges which are being built for the company, under the supervision and management of Paul E. Morse, of Oakland, Calif., who is now in Malaya. Mr. Morse constructed a number of dredges in the Hammonton and other California dredging fields. The name of the new dredge is the "Marie Louise," and it was formally christened by Mrs. K. R. Coullie, wife of the agent in Perak for the Chartered Bank of India, Australia and China.

Fairbanks Exploration Output Comes Up to Expectations

Fairbanks Exploration, subsidiary of U. S. Smelting Refining & Mining, has shipped gold to the value of $800,000 from the season's operations at Fairbanks, Alaska. One of the three dredges was late in getting to work. This is the first season of production by the company. Results compare favorably with estimated results based on drilling records. It is proposed to add two more dredges to the fleet next summer, and the order may be increased to four, depending on the decision of the head office.

Mountain Copper Employs 100

At No. 8 mine of Mountain Copper, Shasta County, Calif., about 100 men are reported to be at work, and preparations are being made to put the flotation mill in operation again. This mine has been only recently reopened.

Test Leaching Process for Quicksilver Ores

At the Great Northern quicksilver property, 26 miles northwest of Yreka, Calif., a leaching process is being devised for the treatment of quicksilver ores. A 50-ton plant is being installed. The property is owned by L. Aubury, W. W. Young, and G. James.

Tintic Mine Sinking Shaft

Machinery has been moved to the new, or No. 2, shaft of the Crown Point Mining Company, in the Tintic district near Eureka, Utah. Two new buildings have been erected, and sinking of the new shaft has been started. John Roundy is manager.

Fig. 1—Extending the spur railroad of National Gold to the portal of the new tunnel

National Gold Developing Properties Near Miller River, Wash.

OPERATIONS at the property of National Gold Corporation, near Miller River, Wash., will henceforth be conducted through a single tunnel, now being driven to tap the known veins, according to W. J. Priestley, vice-president and manager of the company. A survey of the existing situation was made by the company when it took over the 50 claims which comprise the property last year, and the management decided that efficiency and economy could best be obtained by concentrating operations in one tunnel, and extending the narrow-gage railroad from the foot of the old cable tramway, which will no longer be used, to the portal of the new tunnel.

National Gold is a Washington corporation, capitalized at 1,500,000 shares of $1 par, fully paid and non-assessable. The holdings consist of the old Apex mine, with a production record of $550,000 in gold and silver, and the Damon and Pythias group. These are all in the Money Creek district, King County, Wash. The company owns a light mountain railroad, 3-ft. gage, which connects with the Great Northern railroad at Miller River, about 6 miles from the property. It is 125 miles from the Tacoma smelter, to which shipments were made in the past. The elevation of Miller River, lower terminus of the railroad, is 937 ft., and the mines are at an altitude of about 2,200. Work of extending the railroad from the lower terminal of the tramway to the new portal, about one mile distant, is now being pushed. An accompanying illustration shows the method used in bridging Money Creek.

The ore contains arsenopyrite, and occurs in granodiorite, the outcroppings of which have been traced on the surface for a distance of 4 miles. The Apex mine, the largest producer in the group, is developed by several adits, the deepest of which is about 1,600 ft. under the surface. In No. 4 adit, about 1,200 ft. from the portal, some of the best ore has been found. No. 5 adit, 600 ft. below No. 4, will have to be driven an additonal 600 ft. to be vertically underneath this orebody. Smelter returns for the production from the entire mine have averaged $45 in gold and silver a ton.

On the adjoining group, known as the Damon and Pythias, the main tunnel is now being driven. The Damon vein was cut 926 ft. from the portal and 800 ft. below the surface outcrop. Surface work has indicated a length of 3,000 ft. for this vein, with widths ranging from 1½ to 5 ft. Present plans call for continuation of the tunnel to the Apex vein, about 800 ft. distant. In the meanwhile, development of the Damon vein will be continued in both directions and raises will be driven to the surface. Ore broken in development work will be stored for shipment in the spring.

As there are known reserves of mill-grade ore in the Apex mine, and as it is expected that the same conditions will prevail in the Damon, plans have been prepared for construction of a concentrator. Two concentrates will be made, gold-arsenic concentrate being sent to the Tacoma smelter and silver-lead concentrate to another plant, possibly the Bunker Hill smelter. If developments justify additional construction, the company will build a cyanide mill and an arsenic plant.

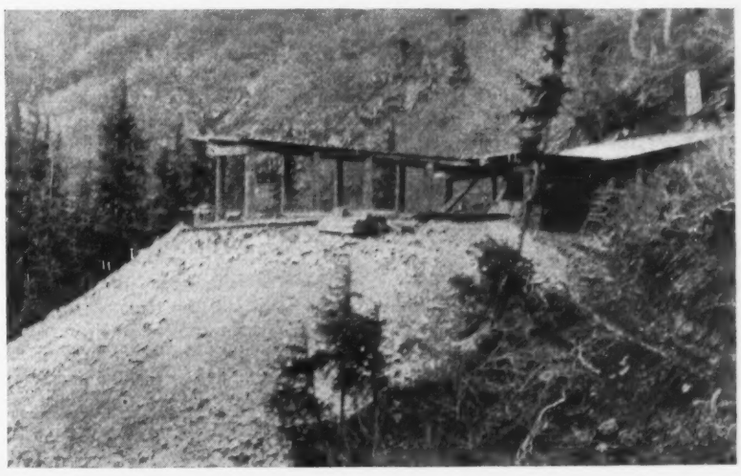
Present equipment on the property includes a hydro-electric power plant, a small test mill, compressors, a locomotive, and caterpillar tractors, recently purchased. Water for the hydro-electric plant is obtained through a 1,650-ft. pipe line, 22 in. in diameter, working under a 250-ft. head.

Drainage Tunnel at Morenci Driven More Than 2,700 Ft.

THE new drainage tunnel being driven at the Morenci branch of the Phelps Dodge Corporation, at Morenci, Ariz., to provide drainage for the Humboldt mine, had been driven 2,720 ft. on Nov. 20, according to W. M. Saben, assistant manager of the branch. The tunnel, when completed, will be 4,300 ft. long. In addition to this work, the company is also remodeling the crushing plant at the No. 6 concentrator. Two 7-ft. Symons cone crushers will be installed, which will perform the work formerly done by a No. 8 gyratory crusher, two Symons 4-ft. disk crushers, and two 54-in. slow speed rolls.

Two shafts, the Joy and the No. 6, will be deepened to the No. 14 level. At Morenci the levels are 50 ft. apart. The Joy shaft, which is the supply shaft for the Humboldt mine, will be deepened from the No. 9 level and the No. 6 shaft, which is used for hoisting ore, will be deepened from the No. 5 level. At present this is the only haulage level in use at the mine.

Fig. 2—Portal of the new tunnel being driven by National Gold, through which all operations will be conducted



McGraw-Hill Increases Its Activities in Chicago

Will Erect Building—Five Papers to Be Published There—E. J. Mehren to Be Resident Vice-President

SIGNALIZING the rapid development of its publishing operations, the McGraw-Hill Publishing Company is having erected for it in Chicago a building to bear its name and for the first time is placing there a resident vice-president as head of its Chicago interests. The building is now in course of erection at 520 North Michigan Avenue, two blocks north of the Wrigley Building, in a rapidly developing new business center, and will house all the McGraw-Hill interests centering in Chicago. The resident vice-president will be Edward J. Mehren, a native Chicagoan, who has been with the McGraw-Hill organization in New York for 22 years in editorial and publishing capacities.

These two moves are a logical result of the rapid expansion of the company's activities in Chicago. It now publishes four papers there, *The Magazine of Business, Factory and Industrial Management, System,* and *Harvard Business Review,* the latter published for the Harvard University School of Business Administration. A fifth magazine, *Industrial Engineering,* will soon be transferred from New York to Chicago.

For 25 years the company has maintained in Chicago large editorial, sales, and circulation staffs, in intimate contact with those who have been making engineering and industrial history in that territory. This intimacy has impressed on the organization the great engineering and industrial strides of the Middle West and its still greater potentialities. To be more intimately a part of that development, present and forthcoming, the company had long planned to publish part of its group of papers there, and having accomplished this purpose, now signalizes its establishment of a great publishing house in Chicago by constructing its own building and establishing there a resident vice-president. More than four hundred employees are now in and attached to the Chicago office.

Edward J. Mehren, the resident vice-president, was born in Chicago and educated at the University of Illinois. After a short period of service in the civil engineering corps of the Burlington and St. Paul railroads, he became associate editor of *Engineering Record,* and, in succession, editor of that paper, editor of *Engineering News-Record,* vice-president in charge of publication of four of the company's magazines, and, finally, vice-president and editorial director, in charge of editorial work of all its properties. Recently, he was appointed editor of *The Magazine of Business* and will continue that responsibility as well as the resident vice-presidency.

James H. McGraw, chairman of the board of the company, has made the following comments on these developments: "The publishing interests of the country have long been aware of the advantages of location near the center of population and industry. These have been advancing steadily westward. The inevitable conclusion is that a house of national interests, particularly when it has a number of papers, should strengthen its position by decentralizing its operations and should not concentrate its forces in one center.

"This step constitutes another forward movement in the steady growth in the McGraw-Hill organization as an effective institution for serving American industry and business. It marks the realization of my hope of many years that the company should have a strong publishing house in the Middle West, at a second major radiating point, giving practical expression, through the various channels of its activities, of the service opportunities and ideals of the McGraw-Hill Company. The organization has always been international and national in thought and purpose. Now it takes another step forward in the physical expression of its aspirations and of the policies expressed in its papers."

EDWARD J. MEHREN

The new McGraw-Hill building in Chicago

Diamond Drilling Started at Cliff and Phoenix

DIAMOND drilling has been started in both the Cliff and Phoenix shafts, in Calumet & Hecla Consolidated's Keweenaw exploration project. From the bottom of each, holes will be driven at right angles to the strike of the fissure veins in which the shafts were sunk. In this way, some idea of the mineralization of the regular veins may be obtained. Crosscutting to promising lodes, followed by drifting, will be the procedure. In both shafts, mass copper taken out of the fissure veins was mined in the early days of these properties. Only in the Pheonix was vein rock mined, a small amount being taken out where it was quite rich near intersections with the fissures.

Calumet & Hecla is opening the conglomerate bed below its 81 level haulage tunnel, which ultimately will be the source of a large tonnage. Stoping is proceeding in the 82 level of A shaft. Drifting is in progress to the south down to the 87 level, inclusive, and to the north from the 81 to the 84, inclusive. Below the 90 level, drifts are being driven to connect the A and C shafts.

Repairs have been completed in two of the company's large furnaces at Hubbell, which are in commission again, and work on the third unit is progressing. In spite of the fact that the smaller furnaces of the plant were used a greater part of the time in October, 12,000,000 lb. of copper was smelted.

Lackawanna Mill Starts

On Nov. 17, operations were started at the new 100-ton flotation plant of the Lackawanna mine, near Silverton, Colo. The plant is handling about 50 or 60 tons daily at present, but operations will soon be increased to capacity. Louis Bastain was in charge of the construction.

Radiore Completes Survey of Champion Territory

THE Radiore Company, of Los Angeles, has completed electrical prospecting for Champion Copper in the 5,000-acre tract north and west of the Champion mine, in the Michigan copper district. This area is owned jointly by Copper Range and St. Mary's Mineral Land, but Champion Copper is doing the exploring. Radiore has given the claims a thorough test, and though copper deposits have not been definitely located, subsequent interpretation may lead to profitable areas. Indications will be chiefly valuable now in eliminating unfavorable territory, such as fractured zones and those with heavy overburden. Radiore data, and a magnetic needle survey by means of which copper-bearing formations were traced, will determine the location of diamond-drill operations in advantageous areas if it is decided to proceed with drilling.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Recent Development Results Disclosed at Teck-Hughes Annual Meeting

TORONTO, Nov. 24, 1928.—At the annual shareholders' meeting of Teck-Hughes Gold, held in Buffalo, on Nov. 19, information was given regarding developments since the date of the annual report. The new south orebody has been drifted on for 300 ft. on one level and for a considerable distance on two other levels. This drifting, together with diamond drilling, indicates a depth for the orebody of at least 800 ft. Neither width nor assay results are given, but they are believed to be approximately the same as in the rest of the mine. The new south shaft is now down 170 ft. The central shaft is down to the No. 22 level, but no lateral development work has been or will be done until the No. 25 level is reached. To date, the lowest level opened is the No. 19, and the maximum width of the orebody on this level is 35 ft. No drilling has been done below the No. 19 level.

THE recent annual meeting of Lake Shore was a routine affair, the only point of particular interest to mining men being the statement of the president—Harry Oakes—that the company has no immediate intention of increasing mill capacity beyond 1,000 tons daily, its present size.

Pioneer Mining has decided to erect a small pilot mill on the company's Michipicoten gold property. Because of the variable distribution of free gold, to determine the average gold content by ordinary channel sampling methods has been found extremely difficult, and the operators have decided that this can best be done by erecting a 20-ton mill for the purpose of bulk sampling across the full width of the shear zone.

The new branch of the Canadian National Railways which will be built to the Sherritt-Gordon property at Cold Lake will leave the Flin Flon line at Mile 51 and be extended 42 miles in a northwesterly direction.

A recent report of the Canadian Geological Survey deals with the presence of tin at Shatford Lake, in Manitoba. The presence of cassiterite in the area and the fact that pegmatite dikes are numerous and carry a varied assemblage of minerals known to be frequently associated with cassiterite give encouragement to the prospector. Possible tin-bearing areas in this district have not been thoroughly prospected and more extensive work may prove the presence of other types of tin deposits besides those directly associated with pegmatite dikes. The government report points out that the large commercial primary tin deposits of the world are not in pegmatite, but are in highly altered zones within granite bodies and sediments which have been intruded by granite.

At a meeting of the directors of Capital Rouyn, a report presented by the manager attached considerable importance to a recent gold discovery on the company's property in the Rouyn district. Shaft sinking will be started on the new deposit. In the meanwhile the contract to sink to 550 ft. in another section of the mine has been temporarily suspended in the belief that the recent discovery is more important.

Mexico City Letter

BY W. L. VAIL

Special Correspondent

Flotation Materials Will Pay No Import Duties in Mexico

MEXICO CITY, Nov. 19, 1928.—The Treasury Department of the Mexican government has issued instructions to customs officials to permit the entry, without import duties, of all materials used in the flotation processes at the Mexican mines. This will probably result in large savings for many of the more important companies, particularly those mining complex ores in the treatment of which flotation plays an important part.

The medical staff of the mining division of the Department of Commerce, Industry, and Labor is being reorganized as a part of the safety program of the division. Efforts are being made to enforce the safety provisions of the mining law more rigidly, for the better protection of miners.

ACCORDING to a statement just released by the mining division of the Department of Commerce, Industry, and Labor, the general mining situation at the end of the first eight months of the year is, on the whole, satisfactory. Applications for government leases of new properties considerably exceeded the number of the same period of 1927. A total of 1,770 applications were filed from all parts of the republic for exploration and working privileges, an increase of 8.2 per cent over the figures for 1927. Production figures for the principal metals follows:

	Kilos		Change Per Cent
	1928	1927	
Gold	14,776	15,126	—2.44
Silver	2,229,805	2,089,003	+6.70
Copper	39,165,058	38,604,318	+1.43
Zinc	103,929,696	78,904,687	+24.08
Antimony	2,140,445	1,088,379	+49.14
Lead	154,649,267	156,048,026	—0.90
Quicksilver	45,181	62,888	—16.07
Arsenic	5,699,586	5,880,145	—3.17
Graphite	4,016,781	5,163,513	—28.55

The San Martin mine, in the district of San Martin, State of Oaxaca, adjoining the San Juan Taviche property, recently closed by American Smelting & Refining, is preparing to start operations after being shut down for some time. It is controlled by Canadian capital.

Melbourne Letter

BY PETER G. TAIT

Special Correspondent

Closer Co-operation Between Broken Hill Companies Is Being Proposed

MELBOURNE, Oct. 24, 1928.—Speaking at the annual meeting of Broken Hill South, Ltd., Colin Fraser, chairman of the board of directors, recently made several interesting announcements. In regard to the agreement with the labor unions covering wages and working conditions (which expired at the end of 1927 but is still in effect, being renewed from week to week) he said that the Broken Hill mining companies desire to obtain some modifications in the conditions at present existing, particularly in regard to the length of the working week. Under the old agreement, underground employees work 35 hours weekly, which means 27½ effective hours worked in five shifts. This places the Broken Hill mines at a serious disadvantage compared with oversea lead-zinc mines. In addition only two shifts are worked at Broken Hill.

THE big mines of Broken Hill today are: Broken Hill North, Broken Hill South, and Zinc Corporation. These three companies control Broken Hill Associated Smelters, and are also largely interested in Electrolytic Zinc. More recently, Broken Hill Associated Smelters purchased a substantial block of shares in Metal Manufactures, Ltd., and Electrolytic Refining & Smelting of Australia, Ltd., at Port Kembla. (These two companies' interests are bound up with copper.) Mr. Fraser also referred to a proposal for closer co-operation between the three Broken Hill companies, and stated that it was proposed to form an investment trust as a public company to hold the interests of the three companies in the associated enterprises.

The third announcement referred to a proposal which is likely to be carried into effect for the erection of a central power station to supply electric power and compressed air to the three mines. Because of the high cost of coal in Broken Hill, it is proposed to use crude-oil engines. Bids have already been invited for the necessary plant and equipment from British and Continental manufacturers, and F. J. Mars, consulting engineer to the company, has gone to London to deal with the tenders.

In regard to the Mount Morgan mine, an announcement has been made that the New Mount Morgan Mining Company, Ltd., is being formed, with a capital of £200,000 in shares of £1 each. The vendors are to receive 60,000 ordinary shares, and 100,000 preferred shares are to be offered for subscription. The new company will acquire all the Queensland assets for the sum of £135,000. Assets include the mine and plant, stores, and other property; also the Dawson Valley coal mine.

MARKET AND FINANCIAL NEWS

Douglas Foresees Prosperous Future for Copper Industry

THE present situation of the copper market appears to me to be a perfectly natural one, resulting solely from the condition of supply and demand, says Walter Douglas, president of Phelps Dodge Corporation, in an interview published in *Daily Metal Reporter* of recent date. The demand for the metal during the past four or five months has reached such staggering proportions that it could not possibly have been foreseen and hence could not have been anticipated as far as the mines were concerned. When the refined stocks of copper that are being carried by producers showed a material reduction, steps were immediately taken to increase the output at the mines so as to meet the greater demand, but this gain in mine production has not as yet eased the situation to any appreciable extent, as it takes approximately 90 days for the ore that is taken out of the ground to pass through the various stages of production before the copper reaches the ultimate consumers. I believe that it is generally realized that the producers have speeded up production all along the line in order to relieve the market pressure that resulted from the unprecedented buying. I am inclined to believe that the copper mines in the United States are at the present time running at 100 per cent of capacity or very close to that.

Back of the reason for the extraordinary demand for the metal that has come from the fabricators is the fact that the consumption of copper products, particularly in the United States, has made remarkable gains. The metal is being used to a larger extent than ever in those fields that always consumed copper, such as the electrical industry, and in addition to this, new and diversified uses have been found, such as the automotive and radio industries, and new outlets have been opened, with the result that the per-capita consumption in the United States at the present time is about 15 lb. The gain in the per-capita consumption in the United States is well illustrated by the following average in three-year periods:

Per-Capita Consumption
(In Pounds)

1912-1914	8.09
1919-1921	9.79
1922-1924	12.17
1925-1927	14.56
1928- .....(a)	15.00

(a) Estimated.

At one time western Europe used to have a greater per-capita consumption of copper than did the United States, but this situation has now completely reversed itself. At the present time Europe is consuming only about five pounds per capita. It is, therefore, quite obvious that if the consumption throughout western Europe, with its 225,000,000 inhabitants, were to increase only one pound per capita it would require an additional 112,000 tons to supply increased consumption. There is every reason to believe that the demand from Europe will continue to gain, because the need for copper is there and the financial and industrial situation has improved to such an extent that it is now possible to fill these needs to a greater extent than in the past. At the present time a very active campaign is being conducted throughout Europe that is designed to stimulate the use of copper and brass products, and the educational campaign is conducted along similar lines to that which has been used by the Copper and Brass Research Association so effectively in the United States. The consumption during the past four years throughout the world has increased at the rate of 8 per cent per annum, and I am convinced that we have as yet by no means seen the peak of the world's copper consumption. With every large industrial center of the world laying plans for huge hydro-electric and electrification projects, there is bound to be an ever-growing use of the metal. It would appear as though the increased demand in the future will have to come largely from sources outside of the United States. This increase will in turn have to be met by mines other than those in this country. In time Canada will be an important producer of copper. Rhodesia is also a potential producer, and the Katanga properties will have their new leaching plant in operation in 1930, which will give an increase of 30,000 to 40,000 tons from that source. South America will then have to make up the rest of the requirements. It should be borne in mind that there have been no new important copper deposits discovered for some years, but some of the existing mines can be worked to a greater extent than heretofore.

When one considers the recent buying activity that developed in the copper market, the present price level cannot be regarded otherwise than very reasonable.

It would, of course, be extremely regrettable if the price of copper were to reach a point where it would serve to restrict the use of the metal in competition with substitute metals. However, I do not believe that there is any danger of such condition materializing as long as the copper market does not go materially above the 16c. level. Were it not for the restraining influences of the copper producers themselves there is little doubt that copper might at the present time be selling much higher than its present price. Under similar buying conditions in the past price advances have been much greater than recently. The present situation was, of course, created more or less by the panicky condition of the consumers, who feared that there would not be sufficient copper to go around in order to meet their needs. During the past few weeks producers have been doing everything possible to allay such fears and have emphasized the fact that there is no necessity for overbuying. I understand that pretty nearly all the selling agencies have endeavored to restrain the consumers from buying more than they actually needed, for no one is more reluctant to see a runaway market than the producers themselves. Viewing the copper situation from various angles, production, consumption, supplies, selling prices, and others, I cannot but feel optimistic as to the future of the metal.

Copper Dividend Increases Interest Financial District

REFLECTING the highly satisfactory condition existing in the industry, several prominent copper mining companies announced increases and resumptions of dividends during the last few days, enumerated as follows: (1) Calumet & Arizona declared an extra dividend of $1 per share, in addition to its regular quarterly payment of $1.50 per share, payable in December. (2) Phelps Dodge Corporation has increased its quarterly dividend rate from $2 to $2.50 per share, effective with the payment scheduled for Jan. 2, 1929, to stock of record Dec. 18, 1928. (3) Greene Cananea Copper announced a quarterly payment of $1.50 per share, payable Jan. 7, 1929, to stock of record Dec. 13, 1928. Greene Cananea went on a $1 per share quarterly basis in July, following several years' absence from the dividend lists. (4) Inspiration Consolidated Copper Company announced a payment of 75c. per share payable Jan. 7 to stockholders of record Dec. 20. Inspiration suspended dividends in 1927 following the payment of 25c. per share in April of that year.

The News from London

LONDON, Nov. 13, 1928—The feat of towing one of the world's most powerful tin dredges from Europe to Burma has just been accomplished. The "Cambria," which is the second dredge of Northern Tavoy Tin Dredging, Ltd., left Holland last July, reaching the Heinze Basin, its destination, last week. Credit for this performance is due to the company's technical managers, the Anglo-Oriental Mining Corporation, and to Yuba Associated Engineers. The Northern Tavoy Company's territory comprises 520 acres of proved ground containing 22,000,000 cu.yd. and representing over 7,000 tons of concentrates. There are, besides, some 4,500 acres as yet unprospected.

From the financial point of view, the report of Lena Goldfields, Ltd., for 1927 is disappointing. The operating profit from this company's Russian mines, which was £267,888 in 1926, dropped to £135,276 last year. The Lenskoie gold mines yielded 218,740 oz. from 365,800 cu.yd. of gravel washed—a return somewhat lower than previously. It is hoped to have the new Bucyrus dredge completed this month, and, if results are satisfactory, additional dredges will be ordered.

A number of public references have been made during the week urging the stabilization of tin, and it is understood that efforts are still on foot to achieve this. Maurice Gregory, president of the Cornish Institute of Engineers, suggests £250 per ton as a minimum price, and £300 a maximum. As far as Cornwall is concerned, he states, there are "some hundreds of thousands of tons of low-grade ore workable at a profit at shallow depths, with a price of £250 for the metal." The Cornish view is that the big alluvial companies paying large dividends should consent temporarily to restrict production, thus bringing about the desired stabilization. Independent of the foregoing is the opinion of G. Temple Harris, chairman of the Northern Nigeria (Bauchi) Tin Company, referred to in last week's London letter. He said some days ago that "No one would rejoice more than this company, one of the very largest alluvial tin producers in the Empire, if some stabilization in the price of the metal could be brought about." He did not, however, suggest restriction of output as a means to this end.

Treadwell Yukon Shares to Treadwell Stockholders

Alaska Treadwell, Alaska Mexican, and Alaska United shareholders have been given the right to purchase shares of Treadwell Yukon Mining Company, Ltd., at $4.50 per share from Nov. 1 to Feb. 1, 1929, according to the allotment of five shares for each share of Alaska Treadwell held; five shares for each two shares of Alaska Mexican held; and five shares for each four shares of Alaska United shares held.

International Nickel Third-Quarter Earnings Increase

The financial summary of operations of the International Nickel Company through the third quarter of 1928 is shown in the accompanying tabulation: It is the company's policy to release this information in statistical form only, and no explanation of its individual items, or of general conditions, is offered.

Comparative Consolidated General Balance Sheet

Assets	Sept. 30, 1928	Dec. 31, 1927
Property	$57,032,561	$53,496,185
Investments	1,680,019	1,571,277
Inventories	7,809,381	9,821,478
Accounts and bills receivable	3,679,501	2,693,651
Deferred installments due on subscriptions for common stock	1,056,980	.....
Advances	114,781	121,014
Government securities	2,730,100	2,730,100
Loans on call	16,000,000	2,200,000
Cash	2,877,212	1,737,454
	$92,980,537	$74,371,161

Liabilities	Sept. 30, 1928	Dec. 31, 1927
Preferred stock	$8,912,500	$8,912,600
Common stock	(a) 46,909,200	41,834,600
Ten year serial 5% purchase money notes	1,800,000	2,100,000
Accounts payable and tax reserves	3,120,354	1,531,312
Preferred dividend payable	133,687	133,689
Insurance and contingent reserves	1,223,077	995,457
Retirement system reserve	245,551	.....
Surplus (including premium on sale of common stock)	(b) 30,636,167	18,863,503
	$92,980,537	$74,371,161

(a) Including $621,625 to be issued.
(b) Surplus credit from premium on sale of common stock, $6,797,377.

Comparative Consolidated General Profit-and-Loss Statement

	Third Quarter Sept. 30, 1928	Second Quarter June 30, 1928	First Quarter Mar. 31, 1928	Nine Months Sept. 30, 1928	Nine Months Sept. 30, 1927
Earnings	$4,130,467	$4,018,952	$2,977,806	$11,127,226	$6,313,491
Other income	140,719	82,925	46,562	270,207	80,263
Total income	$4,271,186	$4,101,877	$3,024,369	$11,397,433	$6,393,755
Administration and general expense	204,365	214,506	179,998	598,870	452,597
Reserved for federal and franchise taxes	330,524	312,240	253,574	896,339	475,812
Net operating income	$3,736,296	$3,575,131	$2,590,796	$9,902,223	$5,465,345
Depreciation and depletion	399,191	388,849	384,702	1,172,742	1,201,254
Retirement system and insurance reserve	118,855	207,680	98,174	424,709	80,771
Profit	$3,218,249	$2,978,601	$2,107,920	$8,304,771	$4,183,318
Dividends, preferred	133,687	133,689	133,689	401,065	401,067
Common	1,255,035	836,692	836,692	2,928,419	2,510,076
Balance to surplus	$1,829,527	$2,008,220	$1,137,539	$4,975,286	$1,272,175

National Metal Exchange Prepares for Opening

THE membership of the National Metal Exchange has been completed, and no more applications can be accepted, according to a recent announcement by Erwin Vogelsang, president, following a meeting of the board of governors at 27 William St. "The 267 memberships of the National Metal Exchange have all been filled, and the board of governors regrets that it has been compelled by the limitations of membership to return many applications, unconsidered, from representatives of metal firms and commission houses who were eligible for membership," said Mr. Vogelsang.

"Interest in the exchange, both here and abroad, is increasing as the opening time approaches, and all indications point to the trading facilities it offers being widely used by both importers and manufacturers, and the trade generally. Every precaution has been taken to safeguard trading and make the exchange of real benefit to those in the metal trade and of economic value to the industry as a whole."

The rates of commission to be charged non-members for a round turn per contract of five tons of tin on the exchange follow:

Trading under 50c. per pound (domestic), $25; between 50 and 60c. per pound, $30; above 60c. per pound, $36, (foreign) $2 additional.

Twenty-four brands of tin will be deliverable against the contracts of the National Metal Exchange. Sixteen of the brands, designated as Class A, will be deliverable at the contract price and eight Class B brands at 1½c. per pound under contract price.

The tenderable brands follow:

Class A—Banka tin; the following brands of Straits tin: Straits Trading Company, Eastern Smelting Company, Po Hin, Ban Hok Hin; the following brands of English Refined tin: Williams Harvey Mellanear refined, Penpoll Special refined, Cornish refined, Capper Pass & Son; the following brands of German refined tin: Th. Goldschmidt "Baum," Berzelius "Rose Brand," Zinnwerke Wilhelmsburg refined; the following brand of Belgian refined: Union Minière du Haut-Katanga; the following brands of Australian refined: O. T. Lempriere & Company, Mount Bischoff, Pyrmont.

Class B—The following brands of English common: Williams Harvey Mellanear common; Penpoll common, Cornish common, Thames Metal Company; the following brands of German common: Th. Goldschmidt "Volta," Th. Goldschmidt "Tego," Zinnwerke Wilhelmsburg common; the following brand of Chinese Tin: Chinese No. 1.

MINING CORPORATION OF CANADA, LTD., reports capacity operation of its Cobalt Reduction unit during the third quarter of 1928. Silver production totaled 327,908 oz. for the period. The company reports prospecting activities.

Tariff Status of Crushed Gypsum Under Consideration

THE status of crushed gypsum imports, hitherto on the free list, is under scrutiny at the Bureau of Customs. The question is whether crushing may be considered as part of the manufacturing process. Domestic producers contend that crushing is always the first step in the treatment of gypsum rock and that crushed gypsum is therefore dutiable at 30 per cent ad valorem as a partly manufactured mineral. Some of the miners claim that it is subject to a duty of $1.40 per ton under the provision for ground gypsum, a charge of almost 100 per cent ad valorem. In opposition, American importers, at a hearing granted by Ogden L. Mills, Assistant Secretary of the Treasury, on Nov. 9, held that the crushing has nothing to do with manufacture, but is merely for convenience in loading and shipping. Under this contention, the crushed material would continue on the free list as crude gypsum. The producers are to be heard soon, and a decision is expected to follow.

McGILVRAY RAYMOND CORPORATION has effected a merger of the McGilvray Raymond Granite Company, California Granite Company, the Knowles Corporation, and the Raymond Granite Company, all California companies engaged in quarrying building granite. Four granite quarries and seven plants in San Francisco, Los Angeles, and San Diego are included in the merger. The value of the properties acquired is about $2,500,000. The new company has a capitalization of 20,000 shares of no par value.

LAKE SHORE MINES, LTD., reports bullion production valued at $3,629,318 during the fiscal year ended June 30, 1928. Bullion production in the preceding year amounted to $3,105,048. Net profit for the last fiscal year was $1,680,881, of which $80,881 remaining after dividend disbursements was added to the surplus reserve fund. President Oakes states that the last year was of particular interest because it saw the virtual completion of the mine and mill expansion program, and that developments on the lower levels of the property have been quite in keeping with results obtained on the upper levels.

MEXICAN CORPORATION, LTD., reports the treatment of 225,038 tons of oxidized ore and 51,936 tons of sulphide ore at its Fresnillo unit. Operating income was $388,927. At the Teziutlan unit 17,203 tons of sulphide ore was treated, yielding an operating profit of $32,811. Both items cover operations during the quarter ended Sept. 30, 1928.

Dissolution of Ray Consolidated Reaches Final Stage

PROCEEDINGS for the dissolution and distribution of the remaining assets of the Ray Consolidated Copper Company, property and assets of which were sold on May 26, 1926, to the Nevada Consolidated Copper Company, for its 5 per cent debenture bonds, have been instituted, and a trustee has been appointed, so that all that will remain will be distributed in cash.

The Nevada Consolidated 5 per cent debentures have been called for redemption on Dec. 31, 1928. Each share of Ray stock surrendered will receive on Dec. 31, 1928, the sum of $15 in cash (which is equal to the face value of Nevada debentures held) plus $1.94, the interest thereon at 5 per cent from May 26, 1926, to Dec. 31, 1928, or a total of $16.94.

CALUMET & HECLA CONSOLIDATED COPPER COMPANY reports for quarter ended Sept. 30, 1928, net profit of $847,638 after taxes, depreciation and depletion. This compares with $744,523 in the preceding quarter and $48,340 in the third quarter of 1927. For the first nine months of 1928, net profit totaled $1,904,360 after above charges, against $272,227 in the first nine months of 1927.

Imports and Exports of Ores and Metals in September, 1927 and 1928

Compiled from U. S. Department of Commerce Records

In Pounds, Unless Otherwise Stated

Imports

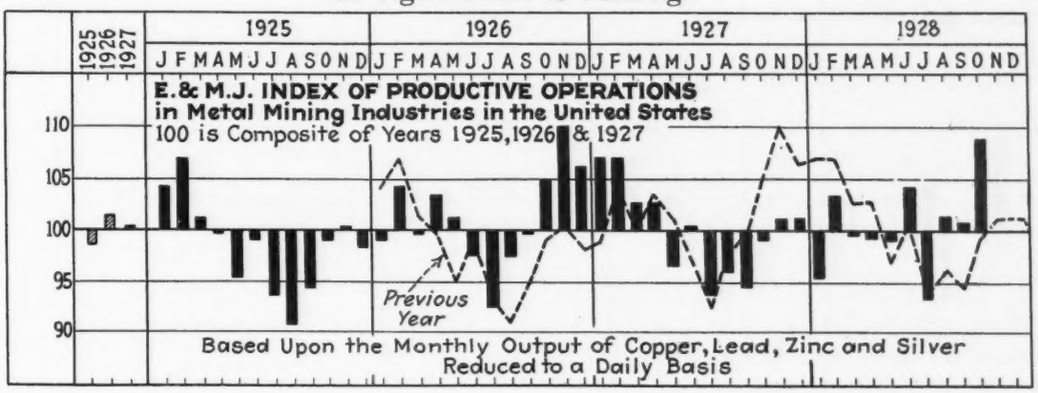
	September 1927	September 1928
Antimony		
Ore { Gross weight	304,257	765,110
Ore { Antimony content	149,130	394,669
Copper		
Ores, copper content	10,153,023	7,418,098
Concentrates, copper content	6,572,935	3,017,100
Regulus, coarse metal, cement copper	172,891	133,390
Imported from		
Spain	286,074	639,587
Canada	7,296,890	3,379,380
Mexico	3,048,250	2,431,047
Cuba	2,328,893	767,400
Chile	3,658,490	1,998,270
Peru	154,954	75,188
Other countries	125,298	1,277,716
Unrefined black converter copper in pigs, bars and other forms	39,714,672	47,324,637
Refined copper	4,560,555	7,145,696
Old and clippings for remanufacture	648,516	758,771
Composition metal, copper chief value	13,995	21,411
Brass, old, for remanufacture	600,452	1,434,070
Lead		
Ore and matte, lead content	5,344,689	3,832,198
Bullion or base bullion	18,922,414	18,598,910
Pigs and bars	2,667	.....
Babbitt, solder and other forms, lead content	132,457	115,180
Type metal, antimonial lead { Gross weight	.....	146,200
Type metal, antimonial lead { Lead content	.....	114,353
Manganese, tons		
Cuba, manganese content	217	103
Other countries, manganese content	35,925	14,960
Pyrites, tons	17,547	26,177
Tin		
Ore, tons	7	10
Bars, blocks, pigs	11,060,281	18,339,283
Imported from		
Netherlands	1,131,750	437,249
United Kingdom	2,543,044	4,066,364
British Malaya	6,532,931	13,423,203
Netherland East Indies	.....	116,650
China and Hongkong	527,407	.....
Australia	190,400	60,480
Other countries	134,749	235,337
Zinc		
Ore, zinc content { Free, less 10 per cent zinc	.....	.....
Ore, zinc content { Dutiable	254,355	244,087
Blocks, pigs and old	5,915	.....

Exports

	September 1927	September 1928
Copper		
Ores, composition, concentrates, unrefined	939,978	44,716
Refined copper in ingots and other forms	82,392,417	61,974,905
Exported to		
Belgium	6,101,518	2,490,265
France	12,528,601	9,515,776
Germany	14,538,644	11,003,213
Italy	5,773,233	11,406,772
Netherlands	13,171,394	2,024,012
Spain	215,429	256,753
Sweden	1,436,222	2,511,363
United Kingdom	21,275,609	11,965,271
Other Europe	3,640,618	783,904
Canada	1,835,574	1,522,723
British India	.....	.....
China, Hongkong, Kwantung	333,735	4,490
Japan	1,231,560	8,380,605
Other countries	310,280	109,758
Old and scrap	3,371,085	3,901,934
Pipes and tubes	172,605	380,733
Plates and sheets	368,005	462,515
Rods	5,323,594	5,219,374
Insulated copper wire and cable	1,600,744	1,805,821
Lead		
In pigs, bars, and other forms	26,436,376	21,371,926
From domestic ore	437,106	1,584,124
From foreign ore	25,999,270	19,787,802
Exported to		
Belgium	112,002	1,232,608
France	1,254,684	336,111
Germany	5,736,628	3,365,453
Netherlands	1,344,184	2,028,010
Sweden	784,211	392,104
United Kingdom	13,164,838	7,976,604
Other Europe	560,074	729,018
Brazil	449,061	526,451
Other South America	900,227	62,071
China, Hongkong, Kwantung	336,563	280,100
Japan	1,611,023	4,145,430
Other countries	182,881	297,966
Other lead manufactures	935,014	1,133,067
Zinc		
Ores and concentrates, tons	500	.....
Dross	613,803	253,255
Cast in slabs, blocks and pigs	9,346,607	2,911,321
Exported to		
Belgium	111,969	.....
France	1,120,938	448,045
Germany	44,868	336,041
Italy	224,076	.....
United Kingdom	5,125,737	8,515
Other Europe	.....	191,353
Argentina	952,408	56,012
Japan	1,232,183	1,792,117
Other countries	534,428	79,238
Sheets and strips, other forms	849,428	691,601
Dust	94,894	119,934
Other zinc manufactures	90,738	51,121

Indicators of Industrial Activity

of Significance to Mining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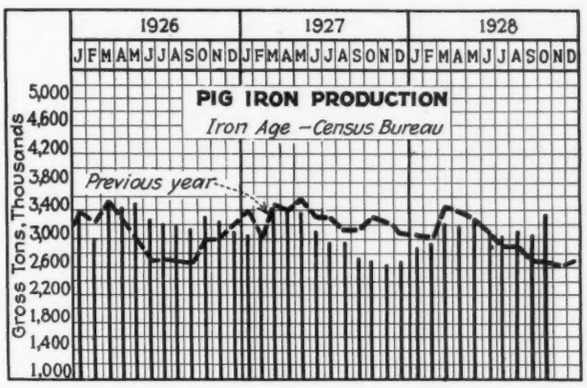
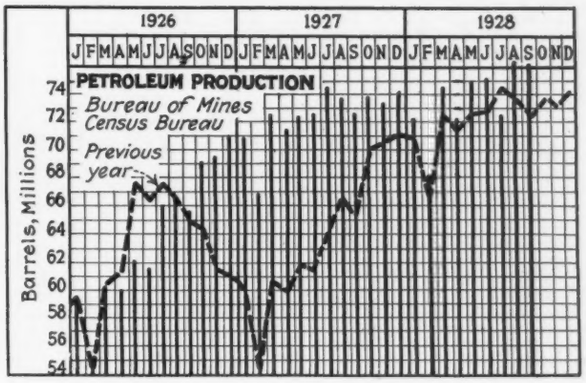
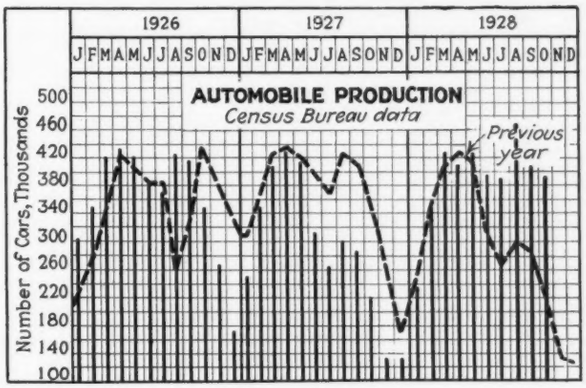
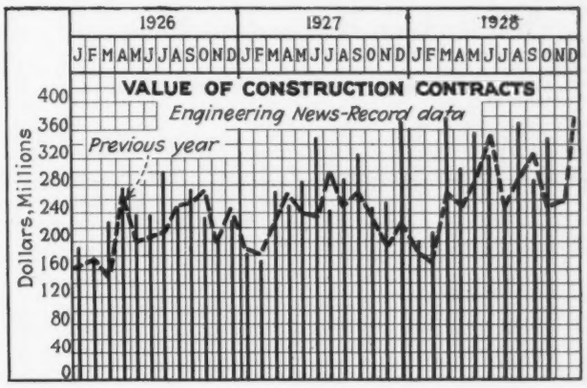
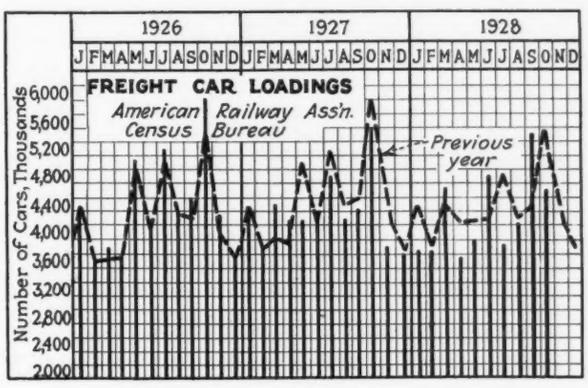
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
E.& M.J. INDEX OF PRODUCTIVE OPERATIONS
in Metal Mining Industries in the United States
100 is Composite of Years 1925, 1926 & 1927
110
105
100
95
90
Previous Year
Based Upon the Monthly Output of Copper, Lead, Zinc and Silver
Reduced to a Daily Basis

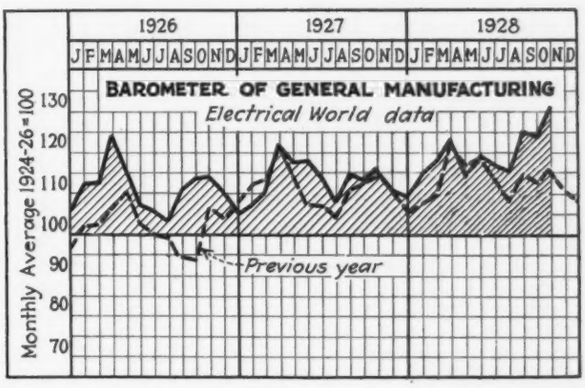












The Market Report

Huge Sales of Zinc Bring Price Advance

Copper, Tin and Silver Comparatively Quiet—Lead Continues in Active Demand

New York, Nov. 28, 1928—The feature of the metal markets for the week ending today has easily been the enormous amount of zinc sold, roughly twice the tonnage of last week, which was in itself the record for at least two years. Prices have advanced about 10 points. Lead has also been in active demand again this week, though the lack of any price advance in London has prevented producers from increasing their quotations here without inviting imports of bullion. Copper has been in average demand at unchanged prices, and silver remains quiet at around 58c. an ounce. Tin continues to advance as a result, apparently, of the bullish tactics of traders rather than because of fundamental conditions.

Daily Prices of Metals

Nov.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
22	15.775	51.25	6.35	6.175	6.25
23	15.775	52.125	6.35	6.20	6.25
24	15.775	52.25	6.35	6.20	6.25
26	15.775	52.75	6.35	6.175@6.225	6.25@6.35
27	15.775	52.75	6.35	6.20@6.225	6.30@6.35
28	15.775	52.75	6.35	6.20@6.225	6.325@6.35
	15.775	52.313	6.350	6.200	6.285

Average prices for calendar week ending Nov. 24, 1928, are: Copper, 15.783; Straits tin, 51.458; N. Y. lead, 6.350; St. Louis lead, 6.179; zinc, 6.250; and silver, 57.958.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis: that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
22	68 5/16	68 3/4	74 3/4	232 1/2	229	21 3/16	21 1/2	25 3/16	25 1/8
23	68 1/4	68 9/16	74 3/4	235 1/2	231 7/8	21 3/16	21 1/2	25 1/16	25 1/4
26	68	68 1/2	74 3/4	239 3/8	235 3/8	21 1/8	21 7/16	25 3/16	25 3/8
27	68 5/16	68 3/8	74 3/4	239 1/8	236	21 1/16	21 5/16	25 1/4	25 1/2
28	68 3/16	68 9/16	74 3/4	240	237 1/4	21 1/16	21 3/8	25 1/2	25 3/4

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver		Gold London	Nov.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
22	4.84 5/8	58	26 3/4	84s11 1/2d	26	4.84 9/16	57 7/8	26 5/8	84s11 1/2d
23	4.84 9/16	58	26 11/16	84s11 1/2d	27	4.84 3/4	58	26 5/8	84s11 1/2d
24	4.84 9/16	57 7/8	26 11/16	.....	28	4.84 3/4	57 7/8	26 11/16	84s11 1/2d
					Ave.		57.938		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Copper Continues Quiet

The copper market has been much the same as last week. Brass manufacturers have taken reasonable tonnages and other consumers have taken a small part in the market, with sales well distributed among most of the different agencies. Connecticut prices remain at 16c., with 16⅛c. generally quoted in the Middle West except at high freight points or for carloads for prompt shipment. Most of the business has been for February shipment, more than half of the expected requirements for that month now being booked. December and January have also been in moderate demand, but there is no interest as yet in March.

Consumers report that they are comfortably covered with copper for such orders as they already have on their books. Some producers are sold out through January, but others have a moderate tonnage available, even for early shipment, should it be required. The lull in foreign demand has eased the domestic situation materially, so that no further price advances are expected in the next few weeks. Consumption of electrical goods is expected to continue through the first half of 1929 at the same high rate that has characterized recent months.

The foreign price continues at 16¼c., c.i.f. European ports, with demand good from Britain and France, but very poor from Germany. Sales this month will be close to the lowest of the year, following the large bookings of the last two months.

Lead Demand Continues

Lead has sold in excellent volume during the last week, the sales tonnage being greater even than that reported a week ago. Large-scale buying has contributed materially to the total, though carload business has been in good volume also. The domestic situation is very strong, and higher prices undoubtedly would have resulted during the last week were it not for the continued lack of strength in London. With prices in the two markets near a balance, an advance on this side would invite the importation of bullion lead.

Corroding has been in somewhat better demand during the last week. Cable manufacturers continue to take lead in excellent volume, contrary to statistical seasonal trend indications. Ammunition, lead foil, plumbing supplies, and battery manufacturers have participated in good volume in the week's business. New year inventory requirements have kept orders from certain directions below the level indicated by the current rate of consumption in these channels.

All business in the East has been at 6.35c. per pound, the level of the A. S. & R. Co.'s contract price. In the Middle

West prices have advanced slightly on the strength of the improvement in demand.

Flood of Orders for 6¼c. Zinc Brings Price Advance

Two sellers each report over 5,000 tons of zinc sold this week, and others have also sold phenomenal tonnages. Galvanizers have fallen over themselves to place orders for shipment varying all the way from prompt to next July, with a heavy tonnage in demand for the first quarter of the coming year. Most of this was sold on Thursday, Friday, Saturday, and Monday, whereupon some sellers advanced their quotations to 6.30c. and others to 6.35c. By today, most sellers were at 6.35c., though there were still offerings by at least one producer at 6.325c. There was markedly less demand than before the advance, but well over 2,000 tons has been sold at the higher levels already. Galvanizing business has improved lately, but much of the buying this week was inspired by the expectation of higher prices rather than to cover orders for manufactured goods.

High-Grade zinc has advanced to 7¾c. for spot carloads delivered in the East, though the general level for contracts is 1c. above the St. Louis price of Prime Western. Electrolytic zinc from Idaho, of an average purity of 99.99 per cent, has sold in satisfactory volume delivered at Middle Western points at 1⅛c. premium above the St. Louis price of Prime Western, and in the East at a premium of 1¼c.

Tin Prices Continue Upward

The Straits tin market offered but little in the form of new developments last week, though prices today are higher by somewhat more than 1c. per pound than they were a week ago. Consumers of tin plate are buying against future requirements in larger volume than they have been accustomed to in the recent past.

Several transactions involving delivery in the summer of 1929 have been consummated. Reports from London have it that the speculative interests there are taking surplus tin off the market and shipping it to unlisted warehouses, whereby it is reflected in statistics as having entered consumption.

Correction—Through error the price of Straits tin on Nov. 16 was quoted at 51.125c. instead of 50.125c. per pound in our issue of Nov. 24. The average for the week, 50.583c. per pound, is correct as quoted.

Silver Steady and Unchanged

There has been no change in the silver market during the last week, and prices have remained almost stationary. India has shown no interest and China still absorbs the limited offerings made in the market. The undercurrent is steady.

Mexican Dollars (Old Mexican pesos): Nov. 22d and 23d, 43⅞c.; 24th and 26th, 43¾c.; 27th, 43⅞c.; 28th, 43¾c.

Foreign Exchange

Closing cable quotations on Tuesday, Nov. 27, were: Francs, 3.91⅛c.; lire, 5.24⅝c.; and marks, 23.84½c. Canadian dollars, 23/128 per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid, New York: Chinese brands, 9⅞c. per lb. for all positions. Cookson's "C" grade, spot 15⅜c.

BISMUTH—Per lb., New York, in ton lots, $1.70. Smaller lots, $1.85 and up.

CADMIUM — Per lb., New York: 70@95c. Market active.

IRIDIUM — Per oz., $280@$290 for 98@99 per cent sponge and powder.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $42@$46. Small lots bring up to $50. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $76. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $71@$72 bid, $72@$73 asked.

QUICKSILVER — Per 76-lb. flask, $123, cash. Small lots command the usual premiums. Market is very quiet.

Prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Nov. 3.

Metallic Ores

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $11@$11.50; Western scheelite, $11.50@$12.00. Nominal.

Chrome, Iron, Manganese, Tantalum, Titanium, and Vanadium ores are unchanged from quotations in the Nov. 3 issue.

Smelters Replenishing Stocks

Joplin, Mo., Nov. 24, 1928

Blende	Per Ton
High	$42.90
Premium blende, basis 60 per cent zinc	$40.00@ 41.00
Prime Western, basis 60 per cent zinc	39.00@ 40.00
Fines and slimes, 60 per cent zinc	36.00@ 38.00
Average settling price, all zinc	39.76
Galena	
High	$86.10
Basis 80 per cent lead	82.00
Average settling price, all lead	83.86

Shipments for the week: Blende, 12,621; lead, 2,983 tons. Value, all ores the week, $751,980.

Shipments eleven months: Blende, 514,642; lead, 90,526 tons. Value, all ores nine months, $27,353,020.

Purchases and shipments of zinc ore are being increased in order to replenish reserve stocks at the smelters before winter weather freezes the ore in the bins at the mines. These purchases are removing from the bins the better grades of ores, and, though stocks are receding, an increased tonnage of less desirable ore is replacing the higher grades in the bins. It is considered better business to retain a firm market price by encouraging production of the higher-grade product than it would be to permit low grade ores to fix the market price. Producers of low-grade ore find less demand each week, and the producers of such ores may be forced to cease operation—a plan superior to one of forcing all mines to close down.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the Nov. 3 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic) Per lb., 4c. Market firm.

COPPER SULPHATE (Blue Vitriol)—Per lb. in carload lots 5½c.

Antimony Oxide, Calcium Molybdate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Nov. 3 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105 quoted for last half, 1928. Spiegeleisen, 19@21 per cent, $33 f.o.b. furnace.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferrovanadium, Monel Metal, Nickel Silver and Yellow (Muntz) Metal are unchanged from prices in the Nov. 3 issue.

Rolled Metals

Copper, Lead and Zinc Sheets are unchanged from prices in the Nov. 3 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of Nov. 3.

Iron, Steel, and Coke

Iron—Per gross ton, Valley furnaces. Bessemer, $18.25@$18.50; basic, $17.50@$18; No. 2 foundry, $18.

Steel—Base prices per gross ton, Pittsburgh, billets and slabs, $33@$34; plates, structural shapes, and soft steel bars, per lb., 1.90@2c.

Coke—Per gross ton, Connellsville furnace, $2.75@$2.85. Connellsville foundry, $3.75@$4.85. By-product coke, Ohio and Kentucky, $7; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ended November 24, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	114⅜	103¾	111⅛	Oc.13, No. 19	Q 1.00
Andes Copper	New York	53⅜	46	51⅜		
Ariz. Com'l	Boston	5	4⅜	4⅜	Jl. 16, Jl. 31	SA 0.25
Cal. & Ariz	New York	133	121	126	De. 1, De. 17	QX 2.50
Calumet & Hecla	Boston	46¼	44⅛	45⅛	No 30, De.15,	Q 1.00
Cerro de Pasco	New York	113⅜	104⅛	113⅛	Oc.11, No. 1	Q 1.25
Chile Copper	New York	73⅛	65	68⅛	De.5 , De.29	Q 0.75
Con. Coppermines	N. Y. Curb	16	14⅜	15⅛		
Copper Range	Boston	25⅛	24⅛	25⅛	Mr. 24, Ap. 20	A 1.00
Crystal Copper	Boston Curb	....	....	*27		
East Butte	Boston	4⅜	4	4⅛	Dec., 1919	0.50
Granby Consol	New York	85⅛	80	83⅜	Oc.11, No.1	Q 1.00
Greene Cananea	New York	173	160	166⅜	De 1 , Ja.7	Q 1.50
Howe Sound	New York	72	67⅜	71	Se.29, Oc. 15,	Q 1.00
Inspiration Consol	New York	48⅜	36⅛	47⅛	De. 20, Ja. 7	Q 0.75
Isle Royale	Boston	26	25	25⅛	Au.31, Se.15	SAX 0.75
Kennecott	New York	148⅛	136	145⅛	No.30, Ja 2	Q 2.00
Magma Copper	New York	75	66	71⅛	Oc.1, Oc.15	Q 0.75
Mason Valley	N. Y. Curb	2	1⅞	1⅞		
Miami Copper	New York	32	28⅛	31	No.1, No.15,	Q 0.37½
Mohawk	Boston	*43	35½	42	Oc. 31, De. 1	Q 3.00
Montana-Idaho	Spokane	*9½	*9	*9½		
Mother Lode Coal	New York	3⅜	3⅛	3⅜	Je.8, Je. 30,	SA 0.15
Nevada Consol	New York	37¼	35	37¼	Se.14, Se.29	Q 0.37½
New Cornelia	Boston	45	40	44½	No.2, No. 19	Q 0.50
Noranda	N. Y. Curb	62⅜	52⅛	62		
North Butte	Boston	7⅛	6⅜	7⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	1⅛	*79	1 1/16	Sept., 1926	0.03
Old Dominion	Boston	20⅛	16⅜	20⅛	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	196	193	195⅛	De.18, Ja.2	Q 2.50
Quincy	Boston	48	43	44	March, 1920	1.00
St. Mary's Min. Ld	Boston	38⅛	35	37	No.20, De.1	1.00
Seneca Copper	New York	5⅜	5	5⅛		
Shattuck-Denn	N. Y. Curb	24⅛	20⅛	22⅛		
Tenn. C. & C	New York	17⅛	16⅛	17	Au., 31 Se.15,	Q 0.25
United Verde Ex	N. Y. Curb	24⅛	23	23	Oc.6, No.1	Q 0.50
Utah Copper	New York	260	250	250	Se.14, Se.29	Q 2.00
Utah Metal & T	Boston	1⅜	1⅛	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	2.52½	2.25	2.27½		
NICKEL-COPPER						
Internat. Nickel	New York	205⅛	187	203	Se.10, Se.29	Q 0.75
Internat. Nickel pfd	New York	120	120	120	Oc.1, No.1	Q 1.50
LEAD						
Gladstone Mtn	Spokane	*5⅛	*4⅛	*4⅛	June, 1927	0.005
National Lead	New York	125⅛	122	125⅛	De.14, De.31	Q 1.25
National Lead, pfd. A	New York	141	140⅛	140⅛	No.3, De.15	Q 1.75
National Lead, pfd. B	New York	118	118	118	Ja. 18, Fe.1	Q 1.50
St. Joseph Lead	New York	46⅛	44⅛	46⅛	Se.8, De.20	QX 0.75
ZINC						
Am. Z. L. & S	New York	48⅛	41⅛	44	May, 1917	1.00
Am. Z. L. & S. pfd	New York	104⅛	99	100	Nov., 1920	1.50
Butte C. & Z	New York	9⅛	8⅛	9	De., 1926	0.50
Butte & Superior	New York	11	10	10⅛	Se.14, Se.29	Q 0.50
Callahan Zn-Ld	New York	3⅛	3	3⅛	De., 1920	0.50
Consol. Lead&Zinc 'A'	St. Louis	9⅛	9	9	Je.25, Jl.1	Q 0.25
Eagle-Picher	Cincinnati	18⅛	18⅛	18⅞	No.15, De.1	Q 0.40
Eagle-Picher pfd	Cincinnati	....	....	100	July 15	Q 1.50
Evans-Wallower	N. Y. Curb	12	10	12		
New Jersey Zn	N. Y. Curb	241⅛	238	241	No. 20, De. 10	X 2.00
Treadwell-Yukon	Toronto	....	....	12⅛		
United Zinc	N. Y. Curb	1⅛	1	1⅛		
Yellow Pine	Los Angeles	*25	*25	*25	Dec., 1925	QX 0.04
GOLD						
Alaska Juneau	New York	8⅞	7⅞	8		
Barry-Hollinger	Toronto	*35½	*25	*32		
Central Manitoba	Toronto	*80	*72	*78		
Cresson Consol. G	N. Y. Curb	*90	*80	*81	Oct. 15,	Q 0.02
Dome Mines	New York	8⅜	8⅛	8⅜	Se.29, Oc.20	Q 0.25
Gold Hill	Toronto	*9¼	*7	*7⅛		
Golden Cycle	Colo.Springs	†1.62	†1.60	....	No. 30, De.10	Q 0.04
Hollinger Consol	Toronto	9.00	8.25	9.00	No 14, De. 1	M 0.05
Homestake Mining	New York	80	80	80	No.15, De.1	M 0.50
Kirkland Lake	Toronto	1.35	1.06	1.35		
Lake Shore	Toronto	18.75	18.00	18.75	De.1, De.15	QX 0.40
McIntyre Porcupine	New York	22⅞	19⅛	22⅞	No.1, De.1	Q 0.25
Portland	Colo.Springs	†*12	*†10	....	Ap., 1927	0.02
Rand Mines	New York	....	....	36⅛	Au.21-28	Am.Sh 1.52
Sylvanite	Toronto	2.30	2.05	2.25		
Teck-Hughes	Toronto	8.75	8.15	8.15	Oc.17, No.1	0.15
Tom Reed	Los Angeles	*30	*30	*30	Dec., 1926	0.02
Vipond Cons	Toronto	*59	*55	*58½	April, 1927	0.03
Wright-Hargreaves	Toronto	2.30	1.83	1.99	Oc.16, No.1	Q 0.02½
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	26	24	25		
Con. Cortez	N. Y. Curb	*18	*18	*18		
Dolores Esperanza	N. Y. Curb	*95	*80	*90	July, 1923	0.05
N.Y. Hond's Rosario	N. Y. Curb	15	14⅜	14⅜	Oc.17, Oc.27	QX 0.50
Premier Gold	N. Y. Curb	2⅛	2⅛	2⅛	Se.14, Oc.4	Q 0.06
Tonopah Belmont	N. Y. Curb	*65	*61	*61	Oc., 1925	0.05
Tonopah Extension	N. Y. Curb	*8	*7	*7	Ap., 1925	0.05
Tonopah Mining	N. Y. Curb	3⅜	3⅛	3 11/16	Se 29, Oc 20	SA 0.07½
West End Consol	N. Y. Curb	....	....	*3	Mar., 1923	0.05
Yukon Gold	Boston Curb	1⅜	*70	1⅜	June, 1918	0.02
SILVER						
Castle-Trethewey	Toronto	*40	*37½	*37½		
Coniagas	Toronto	2.85	2.85	2.85	May, 1924	0.12
Keeley	Toronto	*38	*38	*38	Mr.1, Mr.15	SA 0.04
Mining Corp. Can	Toronto	3.70	3.35	3.55	De.6, De.20	SA 0.1½
Nipissing	N. Y. Curb	3⅛	2⅞	3⅛	Se.29, Oc.20	Q 0.07

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	3⅛	3⅛	3⅛	Ap., 1927	0.12
Bingham Mines	Boston	46½	46	46⅛	Se.20, Oc. 5	MX 0.50
Bunker Hill & Sullivan	N. Y. Curb	....	....	139⅜	Oc. 31, No. 5	X 0.75
Cardiff M. & M	Salt Lake	†*48	†*30	....	Feo. 5, 1927	0.10
Chief Consol	Salt Lake	3.87½	3.87½	3.87½	Ja.10, Fe.1	K 0.10
Consti'n Mng. & Mill'g	Spokane	*54	*48½	*54		
Erupcion	Boston Curb	....	....	*30	Ja , 1928	Q 0.07½
Eureka Lily	Salt Lake	1.45	1.32½	1.45		
Federal M. & S	New York	193½	178⅛	193½	Je., 1927	10.00
Federal M. & S. pfd	New York	102	101½	102	No. 23, De. 15	Q 1.75
Golconda	Spokane	*80	*76	*76½		
Hecla Mining	N. Y. Curb	17	15⅞	16½	No.13, De.14	Q 0.15
Highland-Surprise	Spokane	*13	*12	*12½		
Iron King Mining	Salt Lake	*90	*90	*90		
Keystone Mining	Salt Lake	†*36	†*20	....	Fe., 1926	0.07½
Lucky Jim	Spokane	*24	*24	*24		
Lucky Tiger-Com	Kansas City	†6.75	†6.50	....	No.4, No.20	M 0.05
Mammoth Mining	Salt Lake	†1.30	†*90	....	De., 1926	0.25
North Lily	Salt Lake	8.45	8.40	8.45	Oct., 20	I 0.20
Park Utah	New York	13½	10⅞	12⅞	Se., 11, Oc.1	Q 0.20
Plutus Mining	Salt Lake	1.95	1.95	1.95	Ap.10, Ap.16	Q 0.10
Rico-Argentine	Salt Lake	*54	*52	*54	June 15	Q 0.03
Sherman Lead	Spokane	*28	*25½	*28		
Silver King Coal	Salt Lake	13.50	13.25	13.37½	Se.20, Oc.1	Q 0.25
Silversmith	Spokane	*8½	*7⅞	*7⅞	Oct., 1926	Q 0.02
Strattons Mines	Spokane	1.70	1.58	1.70		
Sunshine M. Co	Spokane	1.26	1.15	1.26	June 20,	K 0.02
Tamarack-Custer	Spokane	*41½	*40	*40	Sept., 1924	0.25
Tintic Standard	Salt Lake	13.87½	13.37½	13.87½	Se.19, Se.29	QX 0.30
Utah-Apex	Boston	3⅜	3⅛	3⅜	Jl.14, Au.1	K 0.25
IRON						
Bethlehem Steel	New York	84⅛	78⅛	83	Jl., 1924	1.25
Cleveland-Cliffs Iron	Cleveland	149	135	140	Oc.15, Oc.25	Q 1.00
Colorado F & I, pfd	New York	79¾	73½	75	Au.10, Au.25	Q 2.00
Gt. North'n Iron Ore	New York	33	29	32½	Ap. 9, Ap. 30	K 0.75
Inland Steel	New York	75⅛	73⅞	73⅞	No. 15, De.1	Q 0.62½
Republic I. & S	New York	94⅛	87⅛	88⅛	No. 14, De. 1	Q 1.00
Republic I. & S. pfd	New York	111	110⅛	111	De. 14, Ja. 2	Q 1.75
Sloss-Sheffield S. & I	New York	126⅛	122	123⅛	Se.10, Se.20	Q 1.50
Sloss-Snef. S.&I. pfd	New York	111	111	111	Se. 20, Oc. 1	Q 1.75
U. S. Steel	New York	171⅛	165⅛	167⅜	No.30, De.29	Q 1.75
U. S. Steel, pfd	New York	141⅛	141⅛	141⅛	No. 3, No.28	Q 1.75
Virginia I. C. & C	New York	....	....	25⅛	Jan., 1924	1.50
Virginia I.C.&C. pfd	New York	52⅛	51⅛	51⅛	Je. 16, Jl. 2	SA 2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York	....	....	23	Ju.16, Ju.26	K 0.97
So. Am. G. & P	N. Y. Curb	3⅛	3⅛	3⅛		
Alum. Co. of Amer	N. Y. Curb	163	137	157		
Alum. Co. of Amer. pf	N. Y. Curb	107	106⅜	107	Se. 15, Oc. 1	Q 1.75
Vanadium Corp	New York	106⅞	99⅛	102⅛	De.1, De. 15	QX 1.75
Patino M. & E	New York	35⅛	34	35	April, 1928	4s.
ASBESTOS						
Asbestos Corp	Montreal	21	20	20⅜	Jan., 1926	1.50
Asbestos Corp. pfd	Montreal	73	69	70⅛	Se.29, Oc.15	Q 1.75
SULPHUR						
Freeport Texas	New York	49⅛	45⅛	47	Oc.15, No.1	QX 1.25
Texas Gulf	New York	82⅛	76⅛	78	De. 1, De 15	Q 1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	58	50⅛	58	No. 20, De 1	Q 0.75
Amer. Metal, pfd. 6%	New York	115	115	115	No.20, De.1	Q 1.50
Amer. Sm. & Ref	New York	284⅜	275⅛	278	Oc.11, No.1	Q 2.00
Amer. Sm. & Ref. pfd	New York	137⅛	137⅛	137¼	No.2, De. 1	Q 1.75
Consol. M. & S	Montreal	331	293	329	Je.30, Jl.16	SAX 6.25
Newmont Mining	N. Y. Curb	210⅜	195	206	Se.28, Oc.15	Q 1.00
U. S. Sm. R. & M	New York	62	57	62	Oc.5, Oc. 15	Q 0.87½
U.S. Sm. R.&M. pfd	New York	54	54	54	Oc. 5, Oc. 15	Q 0.87½

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED November 13, 1928

Name	High	Low	Last	Date		Last Div. Amount
Alaska Mexican ($5)	21/3	18/9	20/--			
Alaska Treadwell ($25)	....	....	....	Nov.,	1926	4 (d)
Aramayo Mines (25 frs.)	61/10½	57/6	58/9	Nov,	1928	5 p.c. (†)
Burma Corpn. (10 rupees)	14/10½	13/10½	14/9	Aug.,	1928	6 annas*
Bwana M'Kubwa (5s)	8/7½	8/1½	8/4½			
Camp Bird (2s)	3/9	3/4½	3/6	April,	1928	16⅔ p.c.
El Oro (£1)	5/—	4/10½	5/—	Nov.,	1924	2½ p.c.*
Frontino & Bolivia (£1)	9/—	8/9	9/—	July	1928	3¾ p.c.
Mexican Corpn.(£1)	9/10½	9/6	9/9			
Mexico Mines of El Oro (£1)	30/—	25/—	27/6	Dec.,	1926	3¾ p.c.*
Mond Nickel	141/10½	132/6	135/—	Aug.,	1928	20 p.c.
Mount Isa (£1)	34/—	32/—	33/1½			
N'Changa Copper Mining	20/3	19/6	20/—			
Oroville Dredging (£1)	4/—	3/7½	3/9	Dec.,	1923	3¾ p.c.
Rhodesian Congo Border (£1)	34/4½	32/6	33/9			
St. John del Rey (£1)	12/3	12/3	12/3	April,	1928	7½ p.c.
San Francisco Mines (10s)	29/4½	28/9	29/—	July	1928	12½ p.c.
Santa Gertrudis (£1)	14/7½	14/3	14/6	July	1928	7½ p.c.
Selukwe (2s. 6d.)	8/7½	7/6	8/—	April,	1917	6¾ p.c.
S. Amer. Copper (2s.)	2/3	2/—	2/1½	Nov.,	1917	75 p.c.
Tanganyika (£1)	66/3	62/3	63/1½	July	1928	5 p.c.
Union Miniere du Haut-Katanga (Brussels)	11,500	10,900	11,500	July,	1928	182.60 (b)

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation.